Railway Maintenance Engineer

Volume 12 CHICAGO: Transportation Building NEW YORK: Woolworth Building SEPTEMBER, 1916 CLEVELAND: Citizens' Building LONDON: Queen Anne's Chambers Number 9

"The publication of the Railway Maintenance Engineer is what I would term one of the greatest educational moves ever made for the benefit of the track department of the United States."

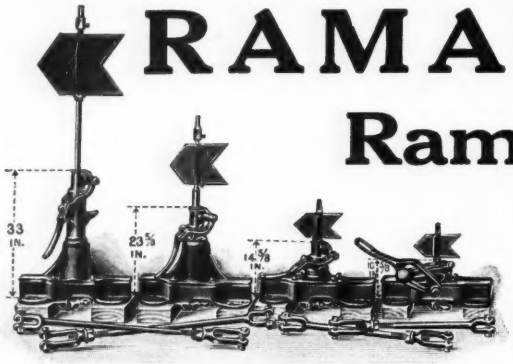
—From a letter from M. GANLEY, Roadmaster, Atchison, Topeka & Santa Fe, Argentine, Kansas

---

"I wish to congratulate you on the uniformly good impression made by your magazine, as expressed by those with whom I have talked on the subject."

—From a letter from E. R. LEWIS, Assistant to General Manager, Duluth, South Shore & Atlantic, Duluth, Minn.

RAMAPO



Automatic Safety Switch Stands are Manufactured only by the

Ramapo Iron Works

Write for Descriptive Catalogues on
Switch Stands, Switches, Frogs, Guard Rail Clamps, Etc.

Manganese Track Work a Specialty.

Ramapo Iron Works Main Office: **HILLBURN, N. Y.**
WORKS: Hillburn, N. Y., and Niagara Falls, N. Y.

The CINCINNATI FROG & SWITCH COMPANY
MANUFACTURERS OF
TRACK EQUIPMENT
FOR STEAM AND ELECTRIC RAILROADS
MINES AND MILLS

CINCINNATI, OHIO

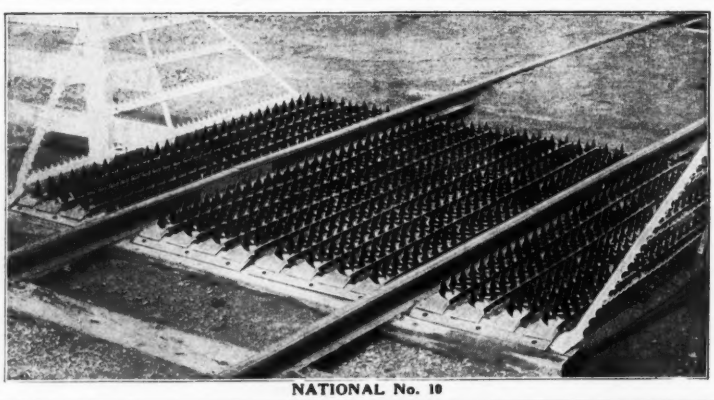
Frogs *Switches* *Crossings* *Stands* 3

ESTABLISHED 1882

THE WEIR FROG CO.

Track Work of Rail and Manganese Steel Construction

CINCINNATI --- --- --- --- --- OHIO



NATIONAL No. 10

The Cattle Guard
Of All-Around Efficiency

Not merely a piece of steel with teeth struck up, but a **mechanical device**, specially constructed to stop the most unruly stock and to withstand all weather conditions.

Made of the best grade of Open Hearth Steel, No. 9 or No. 11 gauge, and coated with specially prepared secret process paint, baked on.

Does not lie flat on the ties and expose itself to corrosive action.

Drop us a card for complete information.

NATIONAL SURFACE GUARD CO.,
The Rookery, Chicago, Ill.

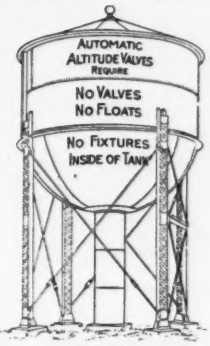
A POSITIVE WATER SUPPLY AT ALL TIMES

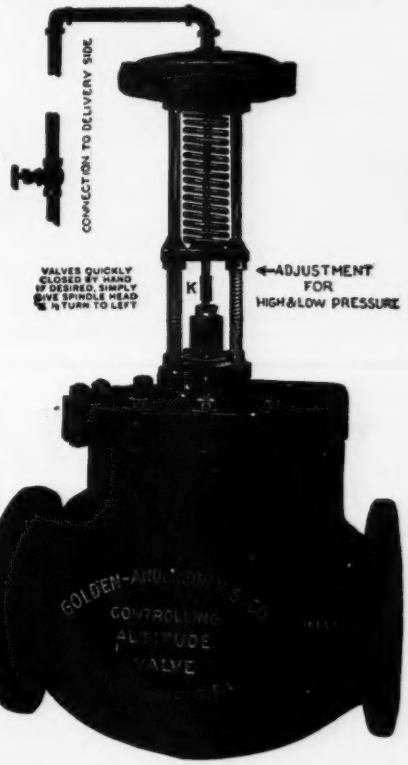
ABSOLUTELY ASSURED BY

G-A. Pat. Cushioned Controlling Altitude Valves

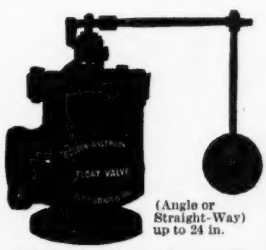
For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyances of Freezing and Float Fixtures inside or outside of Tanks. "Three Ways of Closing These Valves:"

1st—Automatically by water.
2nd—By Electricity, if desired.
3rd—By Hand.




CONNECTION TO DELIVERY SIDE
VALVES QUICKLY CLOSED BY HAND IF DESIRED, SIMPLY GIVE SPINDLE HEAD ¼ TURN TO LEFT
K
←ADJUSTMENT FOR HIGH & LOW PRESSURE
CONTROLLING ALTITUDE VALVE

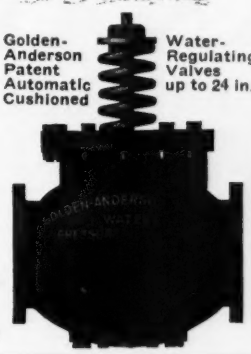
"No Metal-to-Metal Seats"



Golden-Anderson Automatic Cushioned Float Valves

"Always Cushioned in Opening and Closing"

Golden-Anderson Patent Automatic Cushioned



Water-Regulating Valves up to 24 in.

Golden-Anderson Valve Specialty Co.

Water and Steam Specialties

1200 Fulton Bldg. PITTSBURGH, PA.

KILBY FROG & SWITCH COMPANY

Birmingham, Alabama

Manufacturers of

Frogs, Switches, Crossings, Etc.

Manganese Track Work a Specialty

Chicago Tape

The steel ribbon is made of imported steel which is tempered under special specifications.

It is marked on the hardest solder that can be used for this purpose. The combination of factors which produce Chicago Steel Tape were determined on after years of experience in railroad requirements and years of actual tests under all kinds of climatic conditions and ground surfaces.

For your protection, the word "Chicago" is on all our tapes near each end. Chicago Steel Tape resists all kinds of abuse. If it does break we will repair it free.

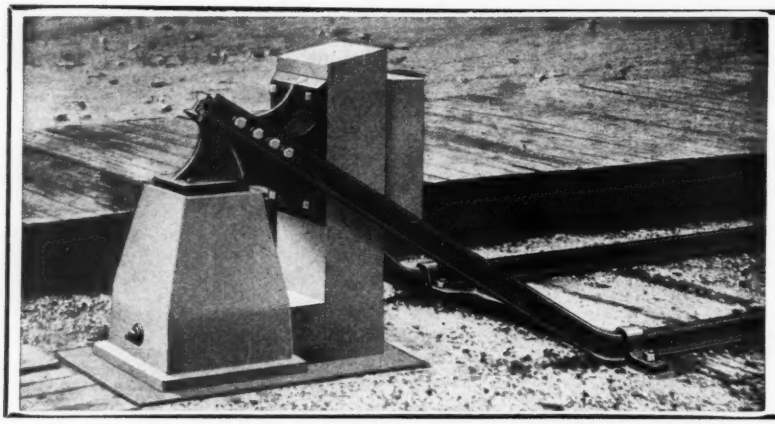
Write for a copy of our Tape Booklet.

Chicago Steel Tape Company

6229 Cottage Grove Avenue

CHICAGO, ILL.

Free Repairs



ELLIS

PATENT

Bumping Post

Simple, Strong and Lasting
Adapted to All Positions

Mechanical Manufacturing Co.
Chicago, Ill.

"INDIANAPOLIS"

R. N. R. Solid Manganese Frogs

Are now so universally used by Leading Railways that we carry them in stock

FOR IMMEDIATE DELIVERY

THE INDIANAPOLIS SWITCH & FROG COMPANY

NEW YORK SPRINGFIELD CHICAGO

Breaking Down Scoop

Double Pointed Railroad Pick

Weight 7 lbs.

HUBBARD

Shield **Brand**
Shovels and **Track Tools**

The growth of this concern during more than a half century is based on their ability to maintain a high standard of quality. Throughout these many years the users of Hubbard tools have always been aware of the fact that not only are they all that is excellent in material and workmanship, but that they cost less in the end.

Write for catalogues and ask for prints of any tools which you especially desire.

Narrow Mouth Strap Scoop

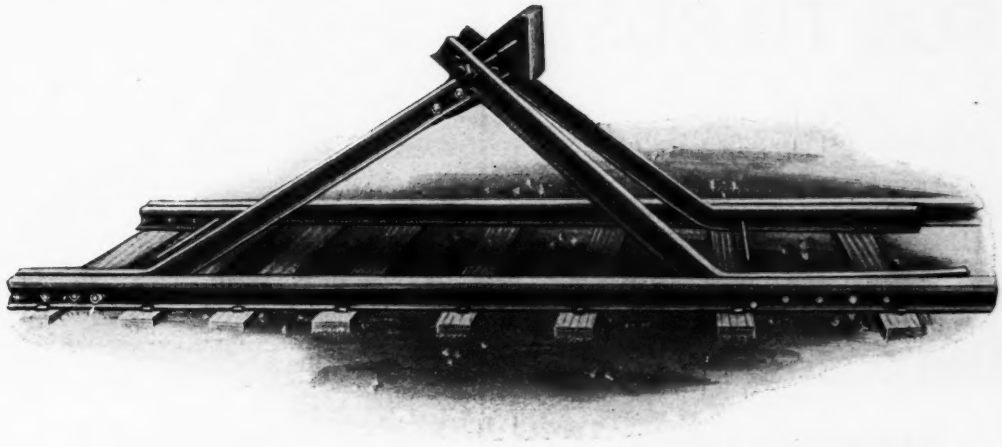
HUBBARD & COMPANY

Pittsburgh, Penn'a.

BUDA ALL STEEL

PATENTED

BUMPING POST



Appearance of Buda All Steel Bumping Post **in a comparative test,** after being hit by a car of coal, total weight 68 tons, at a speed of six miles per hour on a down grade of 3½%, equaling 71,808,000 foot-pounds impact. **No damage done to car,** resiliency of the post acting as a spring buffer.

If you are interested, we should be glad to furnish you full particulars of this test. The only post that was not injured or totally demolished.

The Buda Company

30 Church St. New York

Railway Exchange Bldg. Chicago

113 No. 2nd St. St. Louis

A FOE TO RUST

An everlasting protection for steel and metal work has yet to be found. The nearest to everlasting protection is found in

DIXON'S SILICA GRAPHITE PAINT

The longest service paint.

Mother Nature has worked for ages to get the combination of Silica and Flake Graphite, the pigment in Dixon's paint. This combination has given Dixon's Silica Graphite Paint unusual qualities for resisting acids, storms, rust and other corrosive elements. Records show that two coats of this metal preserving paint, properly applied, have protected metal work for fifteen years.

We will gladly send you Booklet No. 187B, which explains further about this durable paint.

Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Company

Established 1827

B-132

A RIGID TEST PROVED THAT THE PRINCIPLE OF POAGE VALVE CLOSURE IS CORRECT.

The Problem of Water Hammer Solved

Elaborate and rigid tests of various water columns recently made by the University of Illinois proved conclusively that the Poage principle of valve closure is correct.

These tests showed that the first 85% of the valve closure can safely be made very quickly as it is the last 15% of the closure that is entirely responsible for water hammer.

The automatic closing device of The Poage Style H Water Column can be set so that the first 85% of the valve closure can be made in three seconds or less and the last 15% of the closure in from two seconds to three minutes.

THE POAGE STYLE H WATER COLUMN

with the well-known Fenner Drop Spout has been in successful use by a large number of Railroads for years. You will do away with a large maintenance expense by installing it.

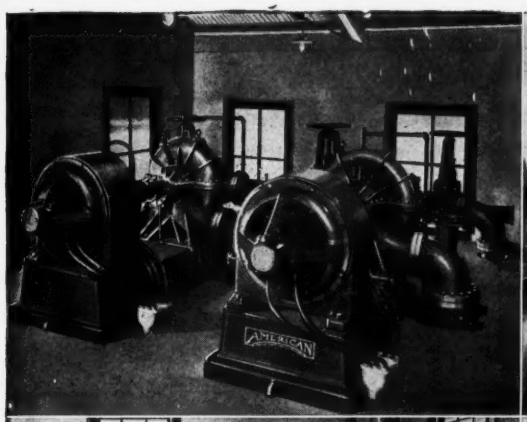
Write for a copy of the University of Illinois report on valve tests, also the illustrated booklet which describes The Poage Style H Water Column in detail.

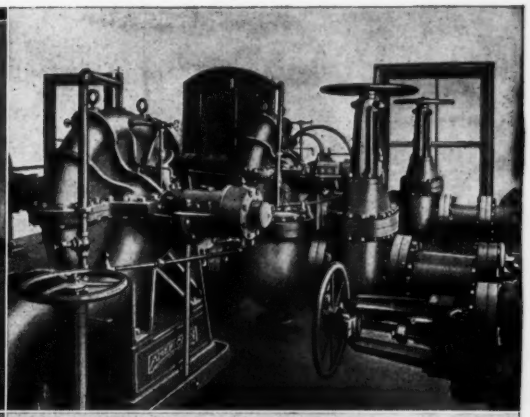
Manufactured exclusively by

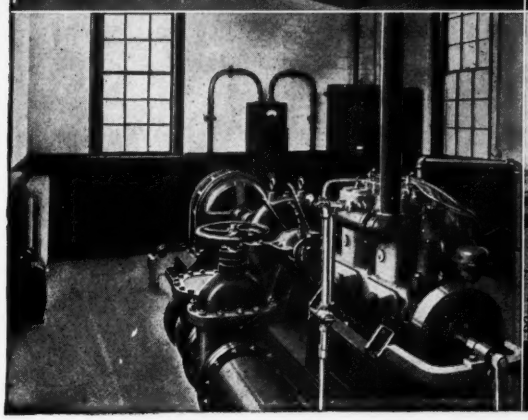
The American Valve & Meter Co.

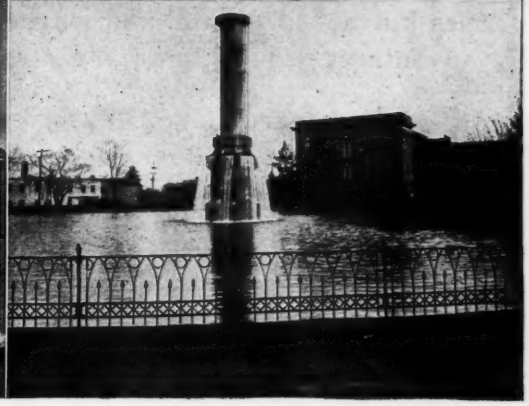
Cincinnati, U. S. A.

AMERICAN









The Highest Head Single-Stage Centrifugal Water Works Pumps in the United States

The City of Lynchburg, Va., is built on several hills bordering the James River and receives its regular water supply through a 22-mile pipe line from a watershed of 40 square miles and an impounding reservoir in the mountains.

The pipe line delivers water to two reservoirs within the city limits, one of 4,000,000 gallons capacity with an elevation of flow of 320 feet above the river, the other of 3,500,000 gallons capacity at an elevation of 220 feet above the river.

In the center of the upper reservoir is a stand pipe with its top 40 feet above the surface of the water for supplying water to the highest part of the city. Water is discharged at the top of the standpipe through a pipe connecting with the main supply line, from where it passes down within the shell and flows over stonework into the reservoir. A pipe line connects the upper and lower reservoirs, and the upper reservoir therefore acts as a reducing valve, so that there is not excessive pressure on mains in the lowest part of the city fed from the lower reservoir.

To provide an auxiliary pumping plant in case the pipe line from the mountains should break, the City of Lynchburg recently installed three "American" centrifugal pumps. These are located in two stations, one containing an 8-inch unit at the upper reservoir for boosting water from the reservoir to the top of the standpipe, the other containing two 10-inch high head units located on the river bank for pumping from the river to the top of the standpipe in the upper reservoir.

Interior views of pumping stations and a view of the upper reservoir are shown in accompanying illustrations.

For the low head unit we furnished an "American" 8-inch, single-stage, double-suction, bronze-fitted centrifugal pump mounted midway between a 50-hp. General Electric squirrel cage, 900-r.p.m. synchronous speed, 3-phase, 60-cycle, 220-volt motor and a 4-cylinder, 5½x6-in. Van Blerck gasoline engine connected by Francke couplings. Pump is left connected with motor and disconnected with engine so that motor can operate pump without injury to engine. When electric current is not available, by connecting engine, pump and dead rotor of motor are operated. Pump was designed to deliver 2,100 g.p.m. against a total head of 60 feet when operating at 865 r.p.m., and we guaranteed a mechanical efficiency of 75%. The official test showed that this unit maintained an efficiency of 79%.

For the high head units we furnished two duplicate pumps. These are designed to operate singly or in parallel and discharge through an 18-inch pipe line a mile long leading from river station to top of standpipe. Pumps are "American" 10-inch, type DTMD, single-stage, double-suction, bronze fitted, diffuser centrifugals, direct-connected by Francke couplings to 300 hp., 1,800-r.p.m., synchronous speed, slip ring, 3-phase, 60-cycle, 440-volt General Electric motors. Each of these pumps was designed to deliver 2,100 g.p.m., against a total head of 412 feet when operated at 1,765 r.p.m., and we guaranteed an efficiency of 78%.

Due to the fact that pumps would operate singly most of the time, the point of maximum efficiency was moved over somewhat, and the most efficient point is on a delivery of 2,500 g.p.m., or a delivery of 2,200 g.p.m. for each pump when operating in parallel. The official test showed that these pumps maintained an efficiency of 79½% when operating singly, and 78% when operating in parallel.

At the time installation was made competitors said that single stage pumps would not do the work, but we proved that the cost was less than two or three-stage pumps of other types to do the same work, and our guaranteed efficiency was four points higher than our nearest competitor. The acceptance test showed that these pumps exceeded our guarantee.

Catalog 132 describes over 50 styles of "American" centrifugal pumps. Write for it.

The American Well Works

General Office and Works: Aurora, Ill.
Chicago Office: First Nat'l Bank Bldg.

It used to be said that it was cheaper to go to the scrap heap for an old switch point and make a derail out of it rather than buy a device designed for this specific use. But this sentiment is now rarely found. In the first place a switch point which is not fit to use in a switch is not fit to use for a derail. And then the very best derail you can make out of a switch point is in reality only a makeshift and a source of annoyance all the time it is in track.

A Hayes Derail made up of just two pieces, fastened to the ties but not to the rail and leaving an unbroken running rail, gives advantages which cannot be obtained in any other way.

And there's an always-on-the-job element about a Hayes Derail that sets a good example to humans.

Hayes Track Appliance Co., Richmond, Indiana.

Front View

Your Next Steam Pump

In your next construction work where you need a steam vacuum pump, a pump designed to handle air, sand, mud, grit, etc., in percentages with the water, impossible by any other kind or make of pump, specify

EMERSON STEAM PUMPS

For the "Emerson" is used for washeries, in cofferdams, for bridge building, railway tanks and roundhouses. If you are after positive service in engineering work your next pump should be an "Emerson."

Side View

Its mechanical motion is positive—thus steam is admitted into the barrels of the pump at positively timed intervals. Engine valve and gear are hermetically sealed—they cannot become clogged or injured.

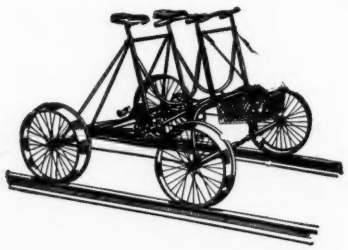
Above all, bear in mind that immediate shipments are made from stock.

Catalog No. 12 contains full data, prices and interesting testimonials. May we forward a copy?

The **New** *Emerson requires no lubrication.*

The Emerson Pump & Valve Company

ALEXANDRIA, VA., U. S. A.

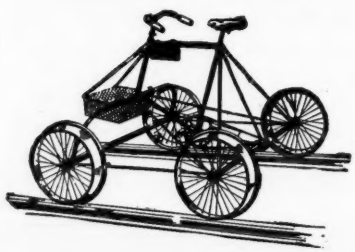


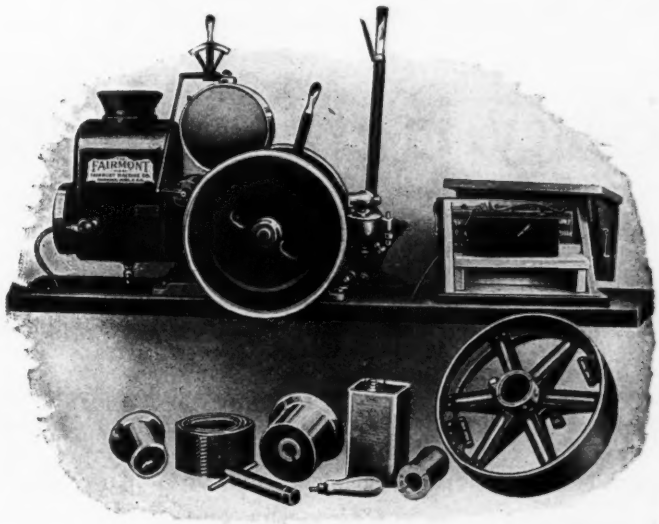
Inspection Cars

Hartley & Teeter Light Inspection Cars are the Strongest and Lightest running known. The fact that we constantly receive repeat orders is proof absolutely that our cars are giving entire satisfaction. We shall be pleased to supply you with our new catalog that tells all about them.

TEETER-HARTLEY MOTOR CO.

HAGERSTOWN, INDIANA





Fairmont Engine for converting Hand Car Truck into Motor Car
4 H.P. 220 lbs. 6 H.P. 350 lbs. 8 H.P. 540 lbs.

WHY SO GOOD

Why do FAIRMONT Hand Car Engines give such unequalled service? You know they have no successful rivals.

1. Water Cooled, they can't overheat and therefore they haul amazing loads for their small size and light weight.

2. Patented FAIRMONT Type of Design combines lightness and smooth power with half the usual gasoline consumption and marvelous range of throttle control.

3. Simple, without 4-cycle poppet cylinder valves, repairs are almost nothing.

4. Ask the Purchasing Agent or Roadmasters of almost any big system. Most of them are constantly buying FAIRMONTS.

5. Write for catalog now—it shows a great line of cars as well as engines.

6. Quantity prices to companies, easy terms to railroad men.

FAIRMONT GAS ENGINE & RAILWAY MOTOR CAR CO.

Formerly Fairmont Machine Company

423 N. Main Street, Fairmont, Minnesota

Efficiency in the Distribution of Printed Matter

PROBABLY more money is wasted in printing and distributing circulars and catalogs than in any other one form of salesmanship.

Only recently we heard of a manufacturer who had received notices from one postoffice in California alone showing the non-delivery of 115 catalogs that had cost him nearly ten cents each, plus the postage! The list from which the envelopes had been addressed was a characteristic office mailing list.

The other common failing in all office mailing lists is lack of completeness. It is impossible for any manufacturer, except at prohibitive expense, to collect and maintain the names of any considerable percentage of those who either buy direct or who influence buying—and the latter are just as important as the former. On the other hand, building an ideal mailing list is part of the regular daily routine of all publishers of high-class papers.

This is especially true in the railway field. For example, take the maintenance department. The RAILWAY MAINTENANCE ENGINEER has on its mailing list the names of more than 5,000 maintenance department officers and subordinates (none lower in grade than track foreman) who subscribe for the paper—several thousands more than can be found in any printed list or on any office mailing list. On one railway alone 627 men of that class are paid subscribers, while the best published list gives but 43 names. On another road the maintenance of way department subscribers number 300, whereas the same printed list shows but 15 of a like class. And these are not exceptions.

Why not save money and at the same time materially increase your sales by using the advertising pages of the RAILWAY MAINTENANCE ENGINEER? It would pay anyone who wants to reach the class of men who read the paper to print his whole catalog in the RAILWAY MAINTENANCE ENGINEER. The distribution would be certain and the contents would be absorbed to the mutual profit of subscriber and advertiser.

Let us show you our mailing list and
prove our ability to serve you.

Simmons-Boardman Publishing Company

New York Chicago Cleveland

Railway Maintenance Engineer

Volume 12 | September, 1916 | Number 9

(With which is incorporated the Engineering and Maintenance of Way Edition of the *Railway Age Gazette* and *Railway Engineering and Maintenance of Way.*)

Published on the last Thursday preceding the date of issue by the
SIMMONS-BOARDMAN PUBLISHING CO.,
TRANSPORTATION BUILDING, CHICAGO, ILL.

NEW YORK: WOOLWORTH BLDG. CLEVELAND: CITIZENS' BLDG.
LONDON: QUEEN ANNE'S CHAMBERS, WESTMINSTER.

EDWARD A. SIMMONS, *President.* LUCIUS B. SHERMAN, *Vice-President.*
HENRY LEE, *Vice-President and Treas.* W. H. WIUM, *Secretary*

ELMER T. HOWSON, *Editor.*
WALTER S. LACHER, *Associate Editor* JOHN G. LITTLE, *Associate Editor*

Entered at the Post Office at Chicago, Ill., as mail matter of the second class.

Subscription price, including the twelve regular monthly issues of the *Railway Maintenance Engineer* and the four daily issues of the *Railway Age Gazette*, published in connection with the annual convention of the American Railway Engineering Association: United States, Canada and Mexico, $1.00; foreign countries (excepting daily editions), $2.00.

WE GUARANTEE that of this issue 5,942 copies were printed; that of these 5,942 copies, 5,218 were mailed to regular paid subscribers, 74 were mailed to advertisers, exchanges and correspondents, and 650 were provided for new subscribers, copies lost in the mails and office use.

The *Railway Maintenance Engineer* has applied for membership in the Audit Bureau of Circulations.

CONTENTS

EDITORIALS 257
LETTERS TO THE EDITOR 259
A MODERN BOARDING CAR 260
METHODS OF REPAIRING TRACK TOOLS 261
A NOVEL METHOD OF DITCHING A CUT; H. M. CHURCH 265
COMING CONVENTIONS 266
PREVENTING RIGHT-OF-WAY FIRES 267
CONSIDERATIONS IN GUARD RAIL DESIGN; JAMES G. WISHART 270
RAILWAY ENGINEERING ASSOCIATION WORK 272
SIMPLE METHODS OF COLLECTING SCRAP; J. B. BAKER 274
TWO BALLAST PLANTS ON THE ALTON 276
COMPARATIVE WATER SERVICE COSTS; P. M. LABACH 278
A MACHINE TO OIL TRACK FASTENINGS 279
SYSTEM IN KEEPING TRACK BOLTS TIGHT; E. D. SWIFT 280
A PORTABLE FRAMING MACHINE 281
A POWER-OPERATED BAR BENDER 282
RENEWING TIES BY CONTRACT 283
OBSERVATIONS ON RAIL JOINT WEAR; G. A. HASETH 283
WOODS USED BY THE RAILROADS; HOWARD F. WEISS 284
AN IMPROVED EMERSON PUMP 285
DETERMINING THE PURITY OF CREOSOTE 285
GENERAL NEWS DEPARTMENT 286

Safety is the first consideration in all branches of railway service. This statement is emphasized so frequently in the abstract that it is well to consider its application to the actual details of the various operations involved in the routine conduct of work. The discussion of track obstructions in another column points out some of the more important precautions which should be observed in the conduct of maintenance of way work. Because of the rapid change in the personnel of the forces and the great difficulty of holding experienced men in the service, increased attention to their proper instruction is necessary. So much of the work of the track and bridge departments involves the safety of train movements that it is a primary duty of the supervisors in charge to pay careful attention to the instruction of the men in this subject. One road is inaugurating a series of surprise tests to satisfy itself that the men understand the rules and follow them under all conditions.

Protecting Weakened Track

The section foreman comes in closer contact with the property owners adjacent to the line than any other employee of the railway. His relations with them are largely those of a neighbor. One problem in which their interests are common is that of preventing fires along or adjacent to the right of way. While one will find an occasional farmer who makes no effort to co-operate with the railway in these matters and who regards a road as a source of revenue through the payment of claims, a foreman will generally find that his efforts to provide fire guards of one kind or another meet with approval and that he can secure the co-operation of adjacent property owners in this protective work. By employing tact and diligence and by exercising reasonable care for the protection of the farmers' property he can generally secure their co-operation also in the maintenance of fences, in the handling of drainage and in similar problems which rise from time to time. The efforts to establish and maintain friendly relations with the farmers along the line form a very important means of protecting the revenue of a railway.

The Railway as a Neighbor

The suggestion made in another column by W. E. Schott that the characteristics of the different classes of labor should be studied and living conditions made to conform to their habits as far as practicable, if the best results are to be obtained, deserves special emphasis. It must be recognized that the American hobo, the Italian, the Mexican, the southern negro and the other races employed in track work vary radically in their racial characteristics, and that the same methods of organization and of conducting work which are applicable with one class are not necessarily equally successful with other nationalities. The methods of feeding the men and the character of the food itself also differ widely. In a year such as this, when many roads are finding it necessary to employ nationalities with which they are unfamiliar, close study can well be given to these racial characteristics in order to work the men most effectively. With the expenditure for wages alone for a floating gang reaching $100 or more per day and with this multiplied many times over a system, the im-

Studying Our Labor

portance of securing the maximum returns is evident. The recent decision of one large Eastern road to undertake a careful investigation of the characteristics, methods of work and habits of living of the various nationalities which it now employs or may employ in the future, can well be followed elsewhere.

Concrete Mixers for Maintenance Work

Although it was at one time the universal practice to mix concrete in large quantities with no other equipment than a few shovels and hoes, the machine mixing of concrete for even the smallest jobs is now generally accepted as the most economical method. In fact, the hand mixing of concrete is frowned upon in some circles and specifications often definitely prohibit it. A justification of this attitude is to be found in the recently reported tests of the United States Bureau of Standards on concrete and mortars made of sands and coarse aggregates selected from various parts of the country. Compression tests made on concrete cylinders, hand mixed by three contractors, showed materially less strength than duplicate specimens made of machine-mixed concrete by the same organizations, the methods followed in each case conforming in every way to actual commercial practice. Notwithstanding the common acceptance of these facts, we still find that small amounts of concrete placed by the division forces on railways are frequently hand mixed, the excuse being that there is not a sufficient yardage in these isolated jobs to justify the moving and setting up of a mixer plant and that the preparatory operations constitute a large portion of the labor charge. In refutation of this idea it is only necessary to call attention to the large variety of styles and sizes of mixers on the market which include some suited to the most diminutive of concrete operations and which can be set up and operated easily by two or three men. The size of mixer most suitable for each organization depends upon the variety and character of work which it is expected to do. Another solution for the machine mixing of small concrete jobs may be found in the adaptation of the mixer car idea as used by some railroads on the larger concrete construction work now being done by company forces in various parts of the country.

THE STRIKE SITUATION

ONE of the most encouraging developments in the controversy between the railways and the four brotherhoods of train service employees has been the manner in which the men in the other branches of railway service have indicated their loyalty to their companies. Only last week a petition signed by approximately 100,000 unorganized railway employees was presented to President Wilson urging that he oppose the demands of the four brotherhoods.

The maintenance of way department, employing the largest group of men in the railway service aside from those involved in the present controversy, has long been noted for its loyalty. In this instance the men in this department realize that the roads, in opposing a raid on their treasury by a group comprising only 18 per cent of the employees (and those the highest paid in the railway service), are fighting the battle of their unorganized employees. The frequent demands of the men in train service in recent years have made impossible adequate wage increases for the men in other departments whom the officers have felt were more deserving. The roads have recently passed through several years of business depression and greatly decreased earnings, forcing a large mileage into the hands of receivers. Now for the first time in several years the earnings have been more satisfactory and many of the roads have taken this opportunity to increase the wages of the deserving men in the unorganized branches of the service.

At this time, when the members of the four brotherhoods have made their exorbitant demands, backed by the threat of a strike, the railways must look to the employees in the other branches of service for support in the crisis they are facing. It would have been the easy thing for the managers to have complied with the demands of the brotherhoods, particularly after President Wilson became their open ally, but to have done so would have meant the sacrifice by the roads of the interests of the other employees. At the time of going to press the danger of a strike is great. If it comes it is to be hoped that the employees of the maintenance of way department will extend to the railways the full support which the managers are relying upon, based upon their knowledge of the long-standing loyalty of these men. After all, the fight of the managers is their fight.

CENTRAL REPAIR SHOPS

LARGE as the direct cost of repairing maintenance of way tools is, this is only a part of the total expense involved. The cost of exchanging tools, particularly if they have been improperly repaired and the service life shortened, the reserve stock which must be maintained, the danger of accidents resulting from improperly repaired tools and the cost of transportation to and from the repair shops, all contribute to the ultimate cost of this work. Too often only the direct expense in the shops is considered and these other large contributing factors are lost sight of. However, well-thought-out plans for the systematic repair of tools must take all of these conditions into account.

No one of the plans described in another column is applicable to all roads. Local conditions of labor, shop location and equipment and the mileage and location of the lines may render impractical on one road a plan eminently suited to another. At the same time, certain characteristics are common to most roads. These point to the economy of a central shop for the repair of maintenance of way tools and equipment. The objection most commonly raised are those of increased haul of tools and the consequent delay. With the proper location of the shop on the average system, it will not be necessary to resort to long hauls, while the delay in repairing tools at a central shop properly administered is less than in the average local shop with its divided supervision.

The most evident advantage of a central shop is the concentration of a sufficient amount of work at one point to enable men to be employed constantly on it and to become proficient in the particular duties. The tempering of tools and their sharpening require knowledge and experience above that of the average blacksmith. The belief prevalent on some roads that any blacksmith can repair tools sufficiently well for all practical purposes is a source of heavy loss and of frequent accidents. A large proportion of the tools returned to service to-day are improperly repaired and do not give the service which they should after passing through the shop. It is for this reason that some of the manufacturers have added repair departments and are offering to repair in their own shops the tools which they make in order that they may render the proper service.

With the concentration of this work for a considerable mileage of lines in one shop, preferably under the direction of the maintenance of way department to eliminate divided responsibility, the improper repair of tools can be detected promptly and measures taken to improve

the practice. While this problem is a minor one from the standpoint of the money involved, its ultimate effect, as evidenced not only in the direct cost of making repairs, but in conserving the time of the men and in reducing injuries, is such as to warrant its careful investigation. It is significant that on the lines where the closest attention has been paid to this subject, the central shop has been very generally adopted.

A HIGHER WAGE RATE

THE serious shortage of track laborers experienced this year is causing many railway men to cast about for ways to avoid a similar recurrence of this difficulty in the future. In the fields of organized labor the problem presented to the railways is that of meeting the united demands of employees without reference to the competition for men by outside industries. In the maintenance of way department the difficulty is that of establishing a wage which will attract men from other employment in sufficient numbers to meet the demands of the roads. The latter is the simpler problem, for it is purely a competitive one.

There is an increasing sentiment among railway men that the labor in the track department must be placed upon a more permanent basis by paying a wage sufficient to attract the desired class of men in the service and to induce them to remain as they become experienced employees. One road which has given this subject careful consideration is now working out an interesting experiment. Early last spring it established a wage rate considerably above that on neighboring railways. Before this went into effect the section foremen were advised that this rate would be justified only if they filled out their gangs with native men from the surrounding country. Although located in one of the most highly developed industrial districts in the United States, with one or two exceptions the foremen were able to secure sufficient local men to fill out at least half of each gang. It was soon evident that the extra wage was more than offset by the increased amount of work performed. In addition, these men who lived in the communities did not require cars to live in, transportation to and from the labor centers, freight on foodstuffs and other concessions commonly granted to foreign employees, none of which are included in the wage rate, but all of which cost the company money. Also of great importance in a year such as this is the increased security against strikes as compared with forces composed largely or entirely of foreigners who are easily led by an agitator from their own ranks.

There is naturally some question as to the effect such a plan would have on the labor market of the country if applied universally on all roads. With the large number of men employed on the sections many railway men believe that it is impractical to secure them in sufficient numbers to fill the permanent forces, and because of this they feel that the native track laborer has disappeared permanently from the railway field. Also, there is reason to understand why an executive officer in charge of a large system would hesitate to authorize an increase in the wage rate sufficient to attract a sufficient number of men to fill out the desired forces on his entire line. On the other hand, the advantages are so evident and the situation is so extreme that the plan is worthy of careful trial on one or two divisions of any large system. Obviously it would not be practical at the present time to extend this plan to other than the permanent forces. The laborers for floating gangs are required in such large numbers and for only a few months of each year that other conditions aside from the wage rate will prevent high grade native laborers from accepting such work.

LETTERS TO THE EDITOR

THE LABOR PROBLEM

CINCINNATI, O.

TO THE EDITOR:

The present period of prosperity and the consequent demand for labor of all classes has brought the track labor problem to an acute stage. It is with difficulty that labor of any kind is now obtained in sufficient quantity for maintenance of way work and the quality of the average force is very low. The work is hard and exacting. The demand for labor in other classes of work where rates are more flexible and follow supply and demand more closely has attracted the better class of men and has left for railroad work, on the floating gangs at least, only those who are below par in intelligence, initiative and ability.

There is, also, at the present time a very noticeable unrest in all classes of labor, which further complicates the problem. If the present business conditions continue, and nothing occurs to change the trend of thought among laboring classes, there is no doubt that the railroads will have to make a radical change in their policy toward labor in the maintenance of way department, if adequate forces are to be obtained to carry on the work.

It is my opinion that the fundamental reason for the existence of a labor problem in the maintenance of way department, is the classification of section forces as unskilled labor, and the payment and handling of these forces on this basis. Track work is a trade. A good section man is not made in a day. True, it does not require the same degree of skill and knowledge to tamp a tie correctly as it does to operate a machine, but it does require some skill and knowledge. The same is true of rail laying, tie renewals, switch work and the other primary duties of the track forces.

Trackmen should be classed as semi-skilled laborers and should be paid accordingly. Instead of allowing the increases in rates paid for other classes of work to force trailing increases to trackmen, leaving for the track forces the unfit, it would appear more logical to set the standard higher and pay for it.

Every trackman knows that proper tamping is absolutely essential to economical track maintenance, and, given a force of skilled men who are physically and mentally fit, it stands to reason that economy will be effected in the amount of work done and the thoroughness with which it is done. And that as much can be accomplished with a smaller force of competent, skilled men as with a larger gang of the rejects.

Granted a rate that will class track forces as semi-skilled labor, the question of permanence or steadiness of employment is the leading factor in the labor problem of this department. Under the present practice the forces are largely increased during the spring and summer, and are cut to the lowest safe minimum during the colder months. This practice makes the work unattractive as a means of livelihood. In the extreme North this practice is perhaps unavoidable, but in the central and southern portions of the country there is really no reason why a great deal of the work that is rushed through with increased forces during the spring and summer cannot as well be handled in the colder months, reducing the labor requirements for the summer and permitting a more nearly uniform number of men to be employed the year round.

True, a great deal of time would be lost by these men

during the winter on account of unfavorable weather, but it is probable that these conditions would similarly affect other classes of semi-skilled labor, so that the status would remain relatively the same. In any case, for a man to make only half time is preferable to being laid off entirely, and the man who is kept on the pay roll during the winter is much more likely to stay during the summer than one who is laid off all winter. I do not wish to be understood as advocating carrying men when the full value of their wages cannot be obtained, but with the proper arrangement of seasonal work much can be found that can be handled to advantage during the winter months, and the force need not be cut to the minimum required to keep the track safe.

Is it not possible that the solution of the track labor problem lies in smaller gangs of more efficient men, permanently employed, and paid a rate that will compare favorably with the prevailing rates for other classes of semi-skilled labor? From such gangs really capable assistant foremen and apprentices can be selected, and a long step would thus be made toward the solution of the foreman problem, also.

A satisfactory substitute for hand labor on track work has not yet been found, and if we want good labor we will have to pay good prices for it. The day of good *common* labor has passed. Common labor is no longer *good,* but is largely made up of the unfit. Track work cannot be handled satisfactorily with the drifting, shiftless class of men who now largely make up track gangs. The track labor problem is really a question as to whether the job is to be made a good job for the good laborer or a common job for the common laborer.

M. of W.

THE INTELLIGENT USE OF TRACK LABOR

SAN MIGUEL, CAL.

TO THE EDITOR:

The construction of railway roadbed and track and their maintenance afterwards have always called for an army of men, and the demand for labor has usually been greater than the supply. Until about 15 years ago most of the track men were Irish, but in late years this nationality has almost disappeared from the service, and Austrians, Italians, Greeks, Mexicans, Japanese and other nationalities have taken their place. In view of the wide difference of opinion regarding the relative efficiency of men of the various nationalities and the large amount of money spent for labor, it is surprising that the haphazard methods followed to-day in the selection of men have been allowed to continue.

If a piece of work is authorized and extra laborers are needed at a time when men are scarce and those of the nationalities previously used cannot be secured, a railway will hire laborers of other nationalities as an experiment. These men are commonly sent out on the line to foremen who have never handled that class of labor before. From the first it is generally seen that the work is far below standard in quantity as well as in quality. Some of the men soon quit, others are discharged and in perhaps a month or two only a few are left. As the foremen are known as capable men, the result is, in most cases, that the men are considered to be inefficient, notwithstanding the fact that frequently the same nationality has given good results on neighboring lines.

Since track work does not require a large amount of physical strength or a high decree of intelligence, there is no reason why one laborer, if satisfied with the conditions of employment, should not be as satisfactory as another, irrespective of nationality, and it would seem advisable to ascertain the reason for this apparent failure. To condemn an entire group of laborers collectively for such reasons seems unwise.

Except in an unusual year, such as the present one, cheap labor can be found if a careful search is made for it. For instance, the Southern Pacific has employed Mexican laborers almost exclusively on its line extending from El Paso, Texas, west almost 1,000 miles to Santa Barbara, Cal., with splendid results and at a considerably reduced cost. Here, as on several other roads in the West, the maintenance of way department has made a study of this problem and has created living conditions satisfactory for the class of labor employed. The men are permitted to live in comfortable quarters and to have their families with them and they are perfectly contented with their $1.25 to $1.50 per day.

To eliminate the continuous search for suitable track men the following suggestions are made: Decide on some kind of labor of which a sufficient supply is available, considering the climatic conditions in the locality where such labor is to be employed; then carefully investigate the habits and customs of this nationality and make every effort to enable the men to adhere to them as much as possible. Adopt a uniform wage scale with perhaps a slight increase for long service. Treat the men well and see that they are handled fairly. Pay for intelligent foremen and train them to handle such labor properly. These methods will do much to improve labor conditions.

W. E. SCHOTT.

A MODERN BOARDING CAR

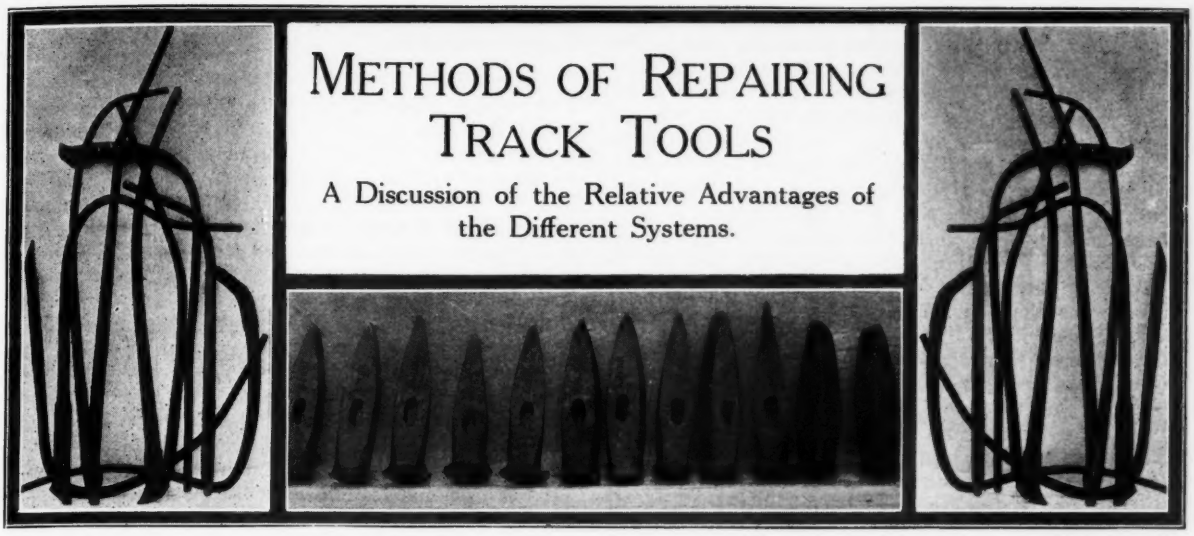
SOME time ago the Bessemer and Lake Erie purchased five 12-section Pullman sleeping cars of wood construction with steel underframes. Two of these cars have been remodeled at the company shops for the use of floating carpenter gangs, who are required by the nature of their work to live away from their homes. As far as possible the interior decorations and finish of the cars were not disturbed. The floor of the entire car was covered with inlaid linoleum.

The smoking room was converted into a kitchen and furnished with a first-class four-plate range, white enamel sink and cupboard for dishes and cooking utensils. A refrigerator with a capacity for 200 lb. of ice is set just outside the kitchen door on the platform of the vestibule. Seats were removed from the four sections adjoining the kitchen and the space used as a dining-room. A dining-table 32 in. by 50 in. with a 48-in. extension, and eight chairs, all of which match the interior of the car, comprise the dining-room furniture, together with a seat of sufficient width to be used as a sofa built along one side of the room. The dining-room is fully equipped with dishes and linen. The remaining eight sections provide sleeping quarters for 16 men and are furnished with the necessary bedding. The stateroom was left untouched and is used by the foreman for an office, where he can make out his reports undisturbed.

Water for cooking and toilet purposes is stored in a tank underneath the car and circulation is caused by compressed air supplied by a hand-operated pump. Heat is supplied by Baker heaters, which also heat the water. Oil lamps are used for lighting.

Two more of these cars are being used by gangs for sleeping quarters only, the kitchen and dining-room facilities being in a converted box car placed at one end of the Pullman. This arrangement allows the use of all twelve sections as sleeping quarters.

We are indebted to H. T. Porter, chief engineer, Bessemer & Lake Erie, for the above information.



METHODS OF REPAIRING TRACK TOOLS

A Discussion of the Relative Advantages of the Different Systems.

Tools Repaired and in Need of Repairs.

THE determination of the proper method of making repairs to track tools is a problem that is deserving of the close attention of maintenance of way men. While the charges to this item, when viewed locally, may appear to be of little consequence, in the aggregate the annual cost of the 295,000 miles of line operated by the railroads of the United States and Canada closely approximates $1,750,000, on the basis of an average cost of approximately $5.75 per mile of line.

While it is too often the case that this money is spent without any definite knowledge on the part of various roads as to the cost of the methods they are using, it is a fact that a number of roads are now making careful efforts to analyze the expense of their methods and to compare the costs and results with those on roads following other plans. In preparing this article the practice of 35 roads, operating approximately 110,000 miles of line, have been studied, and of this total, roads operating 26,000 miles of line are now carrying on independent investigations in an effort to determine the best methods of making tool repairs.

Before determining on any system of making repairs it is advisable that the point at which tools should be scrapped rather than repaired should be determined carefully. On one important railway the chief engineer has issued instructions that sample tools be gathered and that definite limits of wear be set beyond which the tools should be scrapped rather than repaired. For example, a new track shovel measures about 11¾ in. on the blade. It will shovel as well when it is worn down to 6 in. or 8 in. as when new, but, of course, will not enable the man handling it to do more than half as much work. The limits which have been established take into consideration the value of a new tool and the decrease in the amount of work a man can do with a worn tool. Where one has been so worn as to decrease its efficiency and make it more profitable to scrap it than to repair it, it will be scrapped. For example, it has been decided that a track shovel worn to less than 10 in. in length on the blade should not be reissued for track work, but should be utilized in some other manner.

The Collection of Tools

The collection of tools in need of repair and the returning of them to the men or the issuance of others in their stead is preliminary to the actual repair. This operation is generally made under one of two general plans, some roads shipping the tools to the repair shop by the most ready channel, while on other roads supply cars are run over the line at regular intervals. This latter method is employed with many variations.

On the Central Railroad of New Jersey all tools are properly tagged as to the ownership and are moved to the shops by work train, passenger train, or freight train, as may be most convenient. The repairs are made at the shop and the tools are returned through the most ready channel.

On the Pennsylvania Railroad the tools to be repaired and the repaired tools are handled under both methods. Generally they are handled by supply cars making weekly trips over certain prescribed districts, and the practice is to exchange new or repaired tools for an equivalent number of the same class of tools in need of repairs. This exchange is covered by a shop order, and the most satisfactory way is to have this order go direct from the superviser to the shop, without following a roundabout way through a number of higher officers. At other points the tools are shipped back and forth by local freight.

On the Baltimore & Ohio the tools are collected monthly by supply trains and are shipped to central points, where the repairs are made. The tools are then returned to stock at a price which covers the cost of handling and repairing and are then reissued on requisition through the regular channels. On the Missouri Pacific supply cars are run in local freight trains that stop at each section headquarters. New or repaired tools are issued from the cars only in return for broken or parts of broken tools, thus insuring that tools are not being lost by the men. A foreman accompanies the car and inspects all tool houses to see that no reserve stock accumulates over the standard allowance. From one to three weeks is required to cover the assigned territory. On the conclusion of the supply car trip the material collected is shipped to one of the three central plants, where it is separated into reclaimable tools, parts for repair use and scrap.

On the Southern Railway the practice is varied. All broken tools are sent to the supervisor monthly by the foremen. The supervisor is furnished with a large box in which these tools are placed and in which they are sent by him to the roadway shop. The shop foreman replaces the tools received with an equal number of the same kind of either new or repaired tools and returns

them, in the box, to the supervisor. The supervisor then sends them out to the foremen along the line. This method takes out of the hands of the foreman the question of scrapping tools and further requires care in the accounting for tools, as new ones are only issued in exchange for those sent in. Any request for additional tools must be accompanied by a satisfactory explanation.

It may be seen from the above that the method of collecting and returning tools is largely dependent upon local conditions. This is doubly true in adopting methods for making the repairs. Because of this difficulty in formulating any standard method that will cover the various conditions encountered, many roads have not adopted any single system of handling repair work. However, the great majority are following one of the several methods systematically.

METHOD OF MAKING REPAIRS

There are four distinct methods used by the roads in making repairs to track tools. The facilities of the division motive power shops are utilized by a number of roads and the repairs are made by men in the employ of that department. Foreign facilities are utilized by other

SHOVELS AND BALLAST FORKS AWAITING REPAIRS

roads, and under this plan the tools in need of repair are sent to the manufacturers, or local outside blacksmiths are employed. Other roads have adopted the division maintenance of way blacksmith plan, under which the repairs are made in a blacksmith shop operated under the direction of the local supervisor or roadmaster. A fourth plan is the organization of a central plant where the tools in need of repair are accumulated at one or more centrally located points, where the repairs are made by men especially trained in this line of work and generally under the supervision of the maintenance of way department.

On the Chicago, Milwaukee & St. Paul there is no definite system used. All tools are handled through the storekeeper, and, when once issued to the men, the manner of making the repairs is left to the judgment of the different roadmasters. On the Lackawanna an effort is made to centralize maintenance of way repairs at Dover, N. J., but it is not considered economical to send the tools from outlying divisions to this central shop, and in many cases the facilities of the motive power department are used. At Elmira, N. Y., a maintenance of way blacksmith shop is maintained where repairs are made to the tools used on the line for a distance of 50 to 60 miles each way.

The Pennsylvania Railroad is employing all four methods on different parts of its line. The total annual cost of repairs on this road exceeds $100,000, while the cost per year for each man employed varies from a minimum of $3.30 on one division to a maximum of $20 on another, with the average cost slightly more than $7. These variations are due to both local conditions and to the methods employed.

MOTIVE POWER SHOPS

On many roads the facilities of the division motive power shop are utilized. This plan has the advantage over others that the repairs can be made without the installation of special equipment or the hiring of additional forces. It is especially adaptable to roads where the accumulation of work of this nature is small in relation to the miles of line operated and on the outlying divisions of any road where the distances are great to any central point where the repairs might be made.

The disadvantages of the plan are numerous. Probably the greatest is the natural disposition of the mechanical department to slight the work of another department in favor of its own. Moreover, where two departments are involved, as under this plan, there is a division of responsibility which is always unsatisfactory. Disputes between the trackmen and the tool dressers arise with the trackmen claiming that the tools are not properly repaired and the tool dressers claiming that they are improperly used. It is difficult to judge fairly between the two departments, but it is a fact that tool repairing is incidental to the work of the mechanical department and the men rarely become expert in it. It is also a fact that when two departments are involved a wide difference of opinion as to charges is likely to occur. It has happened in many cases where tools are repaired by the mechanical department that the maintenance of way department has felt that it has been discriminated against in the matter of charges, 27 per cent of the tool repair charges on one division being found by investigation to be overhead charges.

REPAIRS BY MANUFACTURERS

The practice of sending tools to manufacturing plants has the advantage over other plans that the repairs are made by expert tool makers, who devote their entire attention to one highly specialized class of work in shops where the best of equipment is provided for carrying on the work, thus insuring good results and a proper temper. The tempering of tools is an art in itself and can be done successfully only by experts. Improper heating when tempering results in breakage and failures later.

The manufacturers who have undertaken to repair the tools have done this in support of their sales department rather than as a commercial project, for they feel that by making the repairs in their own shops the full life of the tools will be realized, a result not always possible where repairs are made by men who are not skilled in this line of work. It is urged as an argument against this plan that the freight charges run the cost up to a prohibitive point, but investigation will show that this is generally over-estimated, as the average cost is less than one cent per tool for a haul of 600 miles. Another argument against the plan has been that a surplus stock of tools must be kept on hand if the repairs were made at tool works, because of the time required for shipment to and from the factory, but experience has shown that these repairs are now being made by the manufacturers and the tools returned to the points from which they came within three weeks of the date of the original shipment, within a 500-mile limit.

To obtain the best results from this method the tools to be repaired should be thoroughly inspected by employees of the road at the point of shipment and those too badly worn for repair thrown out. However, if this is not done by the shipper, in some cases arrangements are made for it to be done at the plant, and an allowance is made to the railroad for the scrap value of the rejected

tools or they are held for the inspection of the proper railroad official. Because of the fact that these repair branches are not operated as a separate commercial project, the cost to the roads is low and compares favorably with that under other plans with the insurance of the best workmanship.

The Rock Island is sending about 50 per cent of its track tool repair work to manufacturers and is repairing the remainder at central shops. The tools that are sent to the manufacturers are collected at Silvis, Ill., and are shipped from and returned to this point in carload lots. The Louisville & Nashville has abandoned the repair of its tools at motive power shops and has entered into an agreement with a manufacturer to make these repairs. Under the method employed by this road each roadmaster assembles the tools in need of repair on his district and ships them direct by freight to the manufacturer. At the same time he forwards a requisition for the repairs to the superintendent for approval. The approved requisition is then sent to the purchasing agent, who places the order for the repairs.

On one superintendent's division of the Pennsylvania Railroad, conveniently located to a commercial tool manufacturing plant, all tools in need of repair are sent to the storekeeper and they are then forwarded by him to the tool works. The repaired tools are returned to the storekeeper and are sent out along the line, according to the shop order. The Pennsylvania is also employing local outside blacksmiths to repair the tools on some of the smaller outlying divisions.

Division Maintenance of Way Shops

In making repairs at division maintenance of way blacksmith shops the advantages of small stock are secured owing to the short haul and the personal supervision of the roadmaster or supervisor in seeing that the tools are not allowed to accumulate in the shop. An added advantage is that the same men are constantly engaged in tool repairing and become more expert in this line of work. A disadvantage of this method is the relatively expensive organization. The Central Railroad of New Jersey, which abandoned the use of motive power shops to establish small maintenance of way blacksmith shops, has overcome this disadvantage, in a measure, by employing the men in the mechanical floating gangs of the maintenance of way department ordinarily engaged in making repairs at drawbridges, etc., in these shops when not otherwise engaged. By utilizing these men in the shops while they are waiting for trains or for quitting time, it is possible to turn out a considerable amount of work which the blacksmiths regularly employed could not do. Also where a maintenance of way shop is in operation small steel parts may be fabricated, parts of machines made or any of the special appliances that the maintenance of way department may be especially in need of may be prepared. If this work were done by the mechanical department more detailed plans would have to be prepared and a large amount of correspondence would be necessary, occasioning much delay.

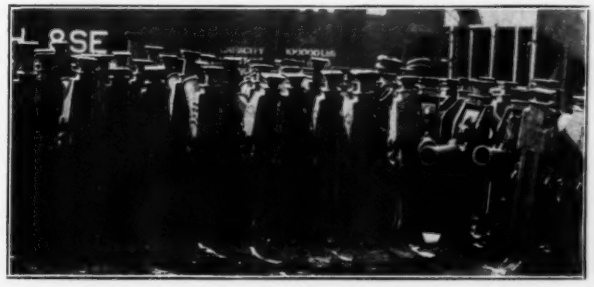
The Philadelphia & Reading is also using division maintenance of way blacksmith shops. Each supervisor is allowed the necessary blacksmith and helpers to carry on the work properly. The shops are equipped with power to operate fans, grindstones, drill presses, carborundum tool grinders, and, in some cases, a steam hammer.

The New York Central, east of Buffalo, is also employing this method, and allows each supervisor a blacksmith and helper and a carpenter. The wood-working repairs are taken care of by the carpenter, while the blacksmith and his helper make the tool repairs.

Central Repair Shops

The use of the central plant is growing in favor. One of the advantages of this plan is the readiness with which it may be operated in connection with the supply and reclamation departments. By operating these plants in connection with the supply department the transferring of material from the shop to the storehouse is done away with, and, furthermore, the proper distribution of tools is assumed without a scarcity on one division and a surplus on another, as often happens when the repairs are handled locally. Such a shop also lends itself readily to operation in connection with frog and switch shops.

The plan has the advantage, in a greater degree than in the division maintenance of way blacksmith shop, that the men become expert in this line of work, owing to the fact that a sufficient amount of it is accumulated to keep them constantly engaged in the same class of work. In this respect this plan equals the utilizing of the facilities of manufacturing plants, and has the advantage that the shops are more conveniently located on the line. It is also possible to send the men working on these tools out on the line occasionally with the foremen, using them



Repaired Track Jacks

as an aid in preparing the tools for the service required of them.

Another advantage of this method is that, because of the large quantities of tools collected at one point, it is possible to make a careful inspection of them and to detect tools that have not given proper service. While this is possible to a limited extent in local shops, the assembling of the tools at one point enables one to ascertain quickly the results they are giving over the system. It is also possible to detect tools that have failed through improper use and to correct the abuses by giving the proper instructions to the men.

The objections most commonly urged against this plan are the long freight hauls and the length of time required for the return of the tools with the consequent necessity of carrying a larger reserve stock in the storerooms. While, because of this delay in rush times during the summer working season, it may be best to send some of the work to division shops, the possibilities of a central plant for the repair of surplus tools during the winter months has special merit. Some roads are now operating in this manner, as the haul in the winter months, when the tools are not required, is not an argument against the central plant. The plan is best adapted to roads with branch lines radiating from ceneral points, where a maximum mileage of lines can be served by a central plant with a comparatively short haul from any portion of the district served.

The Baltimore & Ohio has abandoned the practice of division maintenance of way blacksmith shops in favor of central shops, as the former scheme was not considered satisfactory from several standpoints. Frequently it was not possible to get a good, skilled blacksmith at a local

shop, with the result that a poor quality of work was turned out, and in some cases the cost ran high. This method also led to a surplus accumulation of tools on one division whereas on another there would be a scarcity. As the matter was handled locally it was difficult to get the surplus stock back in circulation. To avoid these difficulties two central plants are now operated, one at Martinsburg, W. Va., and one at Zanesville, Ohio. The economy of the new method was apparent during last year, the total charge against the account being the lowest in ten years.

On the Missouri Pacific the work is handled in connection with the supply department and the reclamation work. Three plants are operated. The supply department maintains a force of mechanics at the central shops, independent of the mechanical department forces, who are experienced or are in training for this particular class of work. The work of reclaiming track materials, such as frogs, switch stands, lamps, etc., is carried on in conjunction with the work on tools and other supplies.

Where tools are collected in sufficient quantities, as at central plants, it is sometimes possible to carry on the repair work on a piece-work basis. This plan has been adopted by the Norfolk & Western at its Roanoke shops, where the following prices prevail:

Dress and straighten lining bar	$0.06
Repair and temper track chisel	.07
Repair and temper track hammer	.15
Dress and temper clay pick (per end)	.04
Re-steel and temper pick (per end)	.125
Dress and temper tamping pick (per end)	.08
Re-steel and temper tamping pick (per end)	.15
Re-dress and shape claw bar	.30

As a detailed example of the central plant and its operation in connection with the reclamation and supply departments, J. T. Bowser, chief clerk in the roadmaster's office of the Cincinnati, New Orleans & Texas Pacific, at Danville, Ky., submits the following:

OPERATION OF A CENTRAL PLANT

The Cincinnati, New Orleans & Texas Pacific extends from Cincinnati, Ohio, to Chattanooga, Tenn., a distance of 338 miles, and is a part of the Queen & Crescent Route. Prior to 1908, repairs to tamping picks, track chisels and other small tools used in the maintenance of way department of this road were made in the shops of the mechanical department at such times as the forces in that department could be put on this work. Little was done in the way of repairs to frogs, switches and switch stands prior to that time.

The arrangement was found to be not satisfactory because of the delays in getting out work. Moreover, it was thought that a great deal could be done in the way of reclaiming material which could not be done under the arrangement then in effect. In 1908, therefore, the employment of a maintenance of way blacksmith and two helpers was authorized, and a small building, convenient to the maintenance of way storeroom and near the main shop at Ferguson shops, Kentucky, which is centrally located, was equipped with the necessary tools and machines for the repair of frogs, switches, switch stands and other material and maintenance of way tools.

The organization for handling material, classifying scrap and reclaiming and repairing second-hand material and tools consists of a maintenance of way department storekeeper, a blacksmith and two helpers, and a machinist and apprentice. A section gang is used for handling and classifying material and scrap. The foreman of this gang reports to the supervisor in all matters pertaining to maintenance of track, but is subject to the call of the storekeeper for handling material in the scrap yard.

The storekeeper, to whom orders for repairs or material are given, and who is directly responsible for maintenance of way material in the storeroom, is necessarily the head of the organization. Under his general supervision the blacksmith has charge of the shop, and directs the work so as to supply the material for which the storekeeper has orders.

The plant consists of a maintenance of way department storeroom, material yards and sheds, scrap bins and tracks, and the repair shops. The shop is a frame building about 20 ft. by 60 ft. in size, situated adjacent to a track on which cars are placed for convenience in handling heavy material to and from the shop.

The shop equipment consists of planer, drills, cut-off saw, forges and chain hoist. An air hoist for handling the heavy material off and on cars is located on the side of the building, adjacent to the track. A stock of repair parts for switch stands, switches, track jacks, etc., is kept on hand by the storekeeper.

All maintenance of way scrap and second-hand material from the entire road, with the exception of scrap rail over six feet long, which is shipped direct to scrap dealers, is shipped to Ferguson shops. The greater part of this material is collected along the line of the road in cars operated in the local freight trains on the first Monday of each month. During the month the section gangs accumulate the scrap at a central point on their respective sections, and the foreman has sufficient men on hand on the day the "scrap car" goes over the line to load scrap without unnecessarily delaying the train. At yards scrap and second-hand material is allowed to accumulate until a carload is on hand, when the car is forwarded to Ferguson shops. On arrival at the shop the cars are placed on the track adjacent to the scrap bins, and the material is unloaded and classified by the section gang. The second-hand material is separated from the scrap, and, if no repairs are needed, it is placed in the storeroom, or, if repairs are required, is delivered at the shop.

The storekeeper is required to make monthly reports of the cost of repairing frogs, tools, etc., so that comparisons of the cost of making repairs of different kinds can be made for each month. The cost of labor for the forces employed in the repair shop averages about $310 per month, including the machinist and apprentice. The cost of labor for the section gang varies widely with the amount of material to be handled and no accurate estimate can be made of this expense.

It is hardly possible to arrive at a definite figure showing the actual saving effected in dollars and cents, for the reason that no record was kept of material that might have been reclaimed before the maintenance of way repair shop was put in operation and the work of reclaiming such material started. Since the system has been in effect a complete record of all material reclaimed has been kept, and a brief outline of what has been and is being done gives a good idea of the saving effected.

Since the shop has been in operation it has not been necessary to purchase any common rail frogs for ordinary maintenance purposes, the only frogs ordered through the purchasing agent being solid manganese or other special frogs, and those required for laying new rail and for additions and betterments. In fact, in a number of instances, frogs have been furnished from the maintenance of way repair shop for these latter purposes. The reconstructed frogs are found to wear as long as new frogs. Practically all switch points 18 ft. and longer which, before the repair shop was started, were scrapped when they became too badly worn at the point for further use are now planed down to be used as shorter points. Also with the occasional assistance of a tinner

or carpenter, lamps, lanterns, oil cans and water buckets are repaired, shovels rehandled, gages repaired and levels fitted with new glasses and plates.

At the scrap bins good parts are taken off broken or worn material or appliances and are used in repairing other appliances of the same kind. The scrap shipments are carefully watched for good spikes and bolts, or other material, and these are re-issued from the storeroom.

A Novel Method of Ditching a Cut

BY H. M. CHURCH,
Division Engineer, Baltimore & Ohio, Baltimore, Md.

A RADICAL departure from the customary method of sloping and ditching was experimented with on the Baltimore division of the Baltimore & Ohio during the past season, and, although there seem to be no authentic unit costs for other methods, this method appears to be reasonably cheap. Between Contee, Md., and Muirkirk, on the Washington branch, the tracks pass through a deep cut known locally as Muirkirk cut. The formation at this point is red and yellow clay and an inferior grade of iron ore, which is smelted in a small blast furnace at Muirkirk, the product being charcoal iron. For a number of years the program of work on the Washington branch has included a large amount of sloping in several cuts. The south side of Muirkirk cut was sloped and covered with street dirt during the season of 1913 and 1914, with a rented contractor's dinkey engine and narrow-gage dump cars. Here the work progressed slowly, as it was necessary to employ a switchback to obtain suitable dumping ground. In addition to this, continual trouble was experienced with derailments and the heavy grades on the dinkey track also had a tendency to impede the progress and run up the cost of the work.

The north side, which had never been sloped, was bare of vegetation and very much weathered with deep gullies. Owing to the clay formation, the ditches became obstructed by sediment which was washed down by rains or rolled or slid down when loosened by the thawing of the ground. This condition not only presented an unsightly appearance to the traveling public as compared with the neat appearance of the southern slope, but caused rough and "pumping" track, owing to the choked ditches and standing water, with mud and clay working up into the stone ballast.

The comparatively flat ground at the top of the slope at this point offered an opportunity to introduce an original method of ditching. A heavy timber truck was built

FINISHING THE SLOPE

and erected on a section of broad-gage track on the flat top of the slope. On the truck was an ordinary stationary double-drum, double-acting 15-hp. hoisting engine with boiler, and also a small 5-hp. reversing engine for swinging the boom. At one corner of the truck a 12-ft. mast was erected, braced by stiffeners. This mast operated a 29-ft. boom.

Large, open-end wooden boxes of about 0.6-cu. yd. capacity were construced with two fixed chains and one detachable chain on the open end for dumping. A large rope was also provided with each box to guide it up the slope and to drag it down to position when empty. Being large and flat, these boxes could be set anywhere on the slope and loaded by the men. When a box was loaded it was dragged up the slope by the derrick (one man steadying it with a hand rope), and it was swung out to the rear of the machine, where it was tripped by

WORKING ON THE SLOPE

another man, whose duty it was also to spread out this waste dirt and count the boxes. About four or five of these boxes were used at once, empty ones being loaded on the slope or in the ditch by laborers while the engine was busy hauling up and emptying the full ones. As the work proceeded the track was removed from behind the engine and built ahead, moves of about 15 or 20 ft. being made at a time.

This waste material was deposited at the top of the slope about 5 ft. back from the edge and formed a dam about 2 to 3 ft. deep and about 15 ft. wide. This dam not only performs the same service as a top ditch and thereby saves the cost of building one, but served also as a driveway for the teams hauling street dirt with which to cover the slope. It also afforded a convenient and cheap method of disposing of the waste material.

The working organization was as follows:

1 engineer.
1 foreman.
1 cart and driver hauling water and coal.
1 water boy (also assisted in hauling water to the engine).
1 man tripping boxes at the top.
2 men building track and clearing ahead.
1 or 2 men taking the boxes up the slope and dragging them down to position.
1 night watchman (who also had steam up in the morning).
16 men sloping and loading boxes (or enough men to load 400 boxes in 10 hr. (Capacity of box, 0.6 cu. yd.)

Total, 26 men.

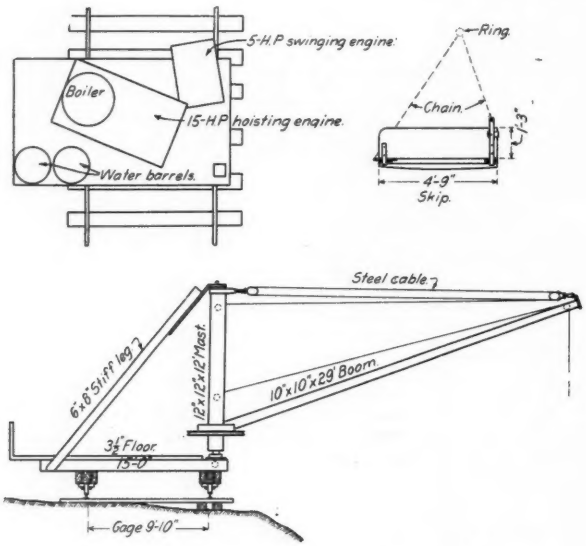
The working capacity of this plant was 400 boxes in 10 hr., working at 100 per cent efficiency. Work was begun on September 11 and was stopped on December 4, during which time 2,100 ft. of cut was sloped and ditched with about 400 ft. still remaining to be done in the spring. Below is the detailed cost of the equipment and handling material:

ESTIMATED VALUE OF PLANT

Estimated present value of 15-hp. double-drum, double-acting stationary engine and boiler	$ 600.00
Nine boxes at $25	225.00
Track and derrick	175.00
Total	$1,000.00

COST OF SLOPING AND DITCHING

Depreciation of equipment	$ 100.00
Rental of swinging engine at $20 per month	50.00
Assembling plant on ground	42.98
Operating engine and derrick	183.27
Watching engine	155.31
Unloading coal for engine	4.92
Repairing derrick	19.68
Team hire hauling water and coal	224.00
Labor sloping and ditching 11,300 hr. at $0.164	1,853.20
Estimated cost of taking down and shipping equipment	75.00
Total cost	$2,708.36



SKETCH OF THE MACHINE AND BOXES

The estimated total yardage handled (with allowance for shrinkage) was 4,650 cu. yd., which gives a unit cost of $0.58 per cu. yd., as compared to a bid of $0.90 submitted by contractors. At one point it was necessary to cross a gully with the engine. This gully is about 50 ft. wide by 15 ft. deep and the cost was as follows:

Teams	$22.00
Grading	50.02
Installing pipe	11.48
	$83.50

The above unit cost per cubic yard for sloping does not include the cost of covering with street dirt.

COMING CONVENTIONS

THE program for the convention of the Roadmasters' Association, which will be held at the McAlpin Hotel, New York, from September 19 to 22, was published on page 228 of the issue of last month. Since that time some other features have been added to the program, including a paper on the operation and maintenance of electrified terminals by F. Boardman, division engineer, electric division, New York Central, which will be presented on Thursday morning.

Reservations are being made rapidly for the special train which will run over the New York Central lines from Chicago. This train will consist of standard sleeping, dining and observation cars. The train will leave Chicago at 6 o'clock Sunday evening, September 17. It will leave Buffalo at 8:05 Monday morning (Eastern time); Syracuse at 11:25 a. m. and Albany 12:45 p. m. and will arrive at New York at 6:25 p. m.

BRIDGE AND BUILDING CONVENTION

The program for the convention of the American Bridge and Building Association, which will be held at the Gruenwald hotel, New Orleans, on October 17 to 19, inclusive, is approaching completion. The convention will open at ten o'clock Tuesday morning with addresses by representatives of the city of New Orleans and by the president of the Association. The annual dinner will be held on Wednesday evening. On Thursday afternoon it is planned to make a tour of the terminals of New Orleans. On Friday, a special train will convey the members and their guests to Slidell, La., where the plant of the American Creosoting Company will be visited. The party will then go to Bogalusa, La., to visit the sawmill of the Great Southern Lumber Company. It is expected that the members from north and west of Chicago will leave Chicago on Sunday morning, October 15, by special train, stopping en route at the Vicksburg National Cemetery and reaching New Orleans Monday evening.

PAINTERS' ASSOCIATION

The thirteenth annual convention of the Maintenance of Way Master Painters' Association of the United States and Canada will be held at the Hotel Walton, Philadelphia, on October 17, 18 and 19, 1916. The detailed program is as follows:

Tuesday, October 17, meeting called to order at 9:45 a. m. Address of welcome by Thomas B. Smith, mayor of Philadelphia, and by Howard B. French, president of the Philadelphia Chamber of Commerce; President's address; Secretary-treasurer's report; Preservative Coatings for Iron and Steel by Leo P. Nemzek, John Lucas & Co.

Tuesday, 2:00 p. m.—Application of Fire Resisting Paints, H. J. Barklay, master painter, Illinois Central; Fire Resisting Paints, W. A. Clapp; Reducing the Fire Loss, G. F. Johnston, Pyroline Products Company; Safety First, M. F. Ebel, master painter, Cincinnati, Hamilton & Dayton.

Wednesday, October 18, 9:45 a. m.—Illustrated lecture on paint, H. A. Gardner, Institute of Industrial Research; Organization and Administration of the Maintenance Painting of Railroad Bridges, by W. S. Lacher, *Railway Maintenance Engineer;* The Sanitary Value of Paint, E. W. Lutes, The Sherwin-Williams Company; What This Association Has Accomplished for the Railways, A. B. Phelps, master painter, New York Central.

2:00 p. m.—The Master Painter's Position in Relation to the Corporation and His Men, H. E. Conrad, master painter, Pennsylvania Railroad; The Influence of Pigment on Paint Permanency, Malcolm McNaughton, Joseph Dixon Crucible Company; Benefit the Railways Received from This Association, Ole Stubsted, master painter, Chicago & Northwestern.

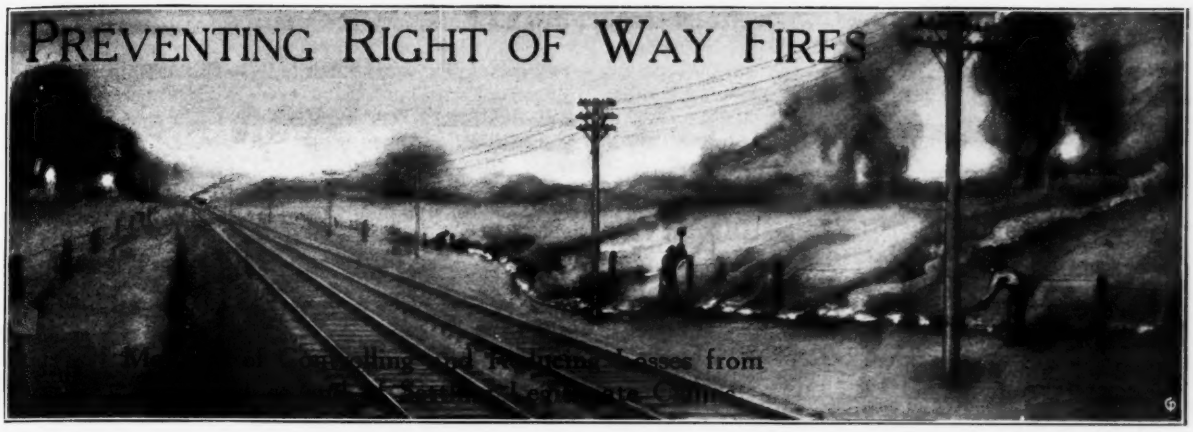
Open discussion on The Accounting of Labor and Material, Finishing Each Job Complete, The Advantage of Motor Cars Over Hand Cars, The Treatment of Cast Iron Radiators, Stencils in the Field.

Thursday, October 19, 9:45 a. m.—Open discussion; an exhibit of photographs of difficult and interesting work; business meeting, election of officers.

2:00 p. m.—Visits to places of historic interest in and about Philadelphia.

Fred C. Rieboldt, master painter, Chicago, Milwaukee & St. Paul, Milwaukee, Wis., is president and F. W. Hagar, master painter, Ft. Worth & Denver, Ft. Worth, Tex., is secretary.

PREVENTING RIGHT OF WAY FIRES



AT this time of the year all employees of the maintenance of way department on most railroads must be on the alert to discover and put out fires on the right of way or adjacent thereto. In some parts of the country these fires become a source of considerable anxiety, while in other localities the situation is not so serious. However, the precautions taken to prevent fires, the measures adopted to discover those which have started and the means used to put them out are of general interest to railway men. A discussion of the subject by E. R. Lewis is followed by a review of the practices pursued on railroads in various parts of the country.

RAILWAY FIRE PREVENTION

By E. R. Lewis

Assistant to General Manager, Duluth, South Shore & Atlantic, Duluth, Minn.

Fire prevention is a matter for universal consideration. Fire is the common enemy, for property destroyed by fire is a real loss. It can be replaced only at the expense of the losers. No one gains anything by a fire loss. If the property burned is uninsured, the owner is commonly the loser. If insured, the insurance company may be called on to make good the loss. The insurance company exists by virtue of premiums paid in advance for fire protection and only a percentage of the loss is recoverable. If a third party is responsible for the loss, he must pay the claim. Lawsuits only result in additional cost to the contestants and a placing of responsibility for payment. Therefore, any organization which has for its object the prevention of fire along a railway right-of-way should include residents within the territory to be protected, as well as employees of the railway company whose lines traverse the territory.

State and Federal authorities are valuable allies in the organization and in the real work of fire prevention. The government forestry department is especially interested and active in lending skilled assistance. The preparations must, of course, begin with the forming of the best possible organization.

It is known that the most favorable start at fire prevention for a railway company is to have a special officer or officers who give their time to organizing those individuals in the different communities who are most interested in fire prevention, and in making arrangements which will best assist those interested persons in bringing others to a realization of the great importance of this movement to the whole community.

Fires are usually caused through carelessness, rarely by viciousness, almost always through ignorance. Education is, therefore, a prime necessity. Naturally, property owners are most vitally interested. The railway companies are large property owners. Their trains must travel by day and by night through districts in which vegetation is often so dry that fires may easily start from a spark from the locomotive smoke stack, from a live coal from the fire-box, from a lighted cigar or cigarette stub, or even from the sun's rays on the curved surface of an empty bottle, or other bit of glass. Tramps and other trespassers on railway property are very often responsible for setting fires.

Enforcement of existing laws against trespass would undoubtedly result in preventing a large percentage of the fire loss. Not only tramps, but hunters, campers and children are frequently careless in lighting and neglecting fires, which spread and cause much damage. An organization for the prevention of fire along railway rights-of-way may be perfected in much the same way as the "safety first" organization. The employees of every department should be interested and their minds kept alive to the importance of this kind of safety. The necessity for faithfulness in carrying out instructions, for being ever on the alert, for keen observation and for prompt action all along the line by all members of the organization is evident.

Operating, mechanical and track department employees and officers of railways are often able to detect and assist in stopping fires. Bridge and building department officers and employees also may have much to do with fire prevention. All employees riding on trains and on inspection cars may at times do valuable service in observing and reporting fires and inflammable material which may cause fires. In most cases freight and passenger trainmen are able to tell when locomotives are setting fires. It is easy to distinguish between fires starting by sparks from the smoke stack and those starting from live coals from the fire-box of a locomotive, especially when looking from the rear of a train. The nettings in stacks should be inspected after each trip of a locomotive. The dampers of fire-boxes should be watched and the shaking of locomotive fires properly controlled. There are certain steep grades on nearly every railway where the danger from fire resulting from locomotives working with ports open is especially grave. These localities should be marked for special treatment by all concerned.

Most railway right-of-way is 50 ft. wide on each side of the center of the single main track. If there is more than one track the right-of-way between the track and the boundaries is even more restricted. Fire cannot ordinarily gain much headway in the 20 to 40 ft. between the grass line and the right-of-way limit. Therefore, it is a wise precaution to clear or plow suitable fire

paths at the right-of-way boundaries. This work involves considerable initial expense, but the expense of maintenance is not great after the first year. A path 6 ft. wide is considered reasonably safe. Where plowing is possible it is effective and comparatively cheap. In some places the grass must be hoed or shoveled away. Vegetation-destroying liquids are sometimes used to keep fire paths clear of grass and weeds, with good results.

Some state laws demanding the mowing of grass and weeds on railway right-of-way are unfair and illogical, and indirectly cause many railway grass fires. It is almost impossible to rake grass clean from the stubble after mowing. It is suggested that if these laws were changed to include only the cutting of noxious weeds and the mowing and back-firing from 6-ft. strips along the shoulders of banks and cuts and along right-of-way boundaries, the best results might be obtained. Growing grass is less inflammable than stubble and wisps of dry hay. Trackmen know this and they ordinarily mow inside the fence lines first. As soon as this grass is dry it is fired where it lays, with the first favorable wind. With the wind blowing toward the track there is no trouble nor danger in thus providing with little expense an effective fire path which will last for a season. Plowing and back-firing are methods of fire protection known to and practised by settlers since the earliest days of western emigration, and now extensively practised by the government forestry department. High winds during protracted seasons of hot, dry weather are conditions most to be feared. Track patrol at such times by night and by day is effective and desirable. The shovel is the fire fighters' best weapon. Earth or sand thrown on the flames is very effective in stopping an advancing grass or forest fire, when water is not available.

It is possible and necessary to remove most inflammable material from railway premises. Chips, grass, refuse timber, driftwood, oily waste and all other refuse should be cleaned from the foundations of bridges, especially wooden structures. Ballast floors and fireproof paint on bridges are fire preventives. Water barrels should be kept filled and fire buckets provided wherever needed at bridges and buildings. Hand grenades and fire extinguishers in trains are often of service in quenching fires along the line.

The practise of placing water barrels on the roofs of buildings is considered wrong, for most fires do not start at the top of a house, but at the base. The water barrel is better placed on the ground near the building and at the foot of a ladder leading to the roof as a better point from which to quench a fire. The ladder should be placed at an easy angle for use. Water-soaked blankets, jackets or any heavy cloth articles are valuable to smother a fire.

Locomotive fire apparatus is especially valuable. A locomotive equipped with 50 ft. of hose and a suitable nozzle may be used effectively to fight forest fires. Many locomotives are so equipped on logging railways, where the slashings formed by woodsmen who leave felled tree tops in the woods cause many fires.

Every railway employee should be always on the lookout for fires. Every smoke should be investigated. Section and extra gangs and crews of logging trains, work trains and way freights should be instructed to assist and co-operate actively in fighting fires, not only on the right-of-way, but in the immediate neighborhood where conditions permit.

If railway employees help residents to fight fires, the residents usually reciprocate to their mutual benefit. During times of special fire danger, lookout towers at favorable locations are valuable. Signal masts frequently serve this purpose for section foremen, who should then patrol their sections both morning and evening. Warnings in trains and stations against the careless throwing away of matches and lighted cigars and cigarettes and glass; bulletins and rules against the opening of grates and the use of locomotive fire shakers while running, will help prevent fires. All observers should note in writing the date, time of day, place, direction of wind and the relative location of fire and railway property, as soon as a fire or distant smoke is seen; for many fires are blamed on railway locomotives which in reality start far off the railway property and from other causes. A wetted finger held up will give the exact direction of the wind to a person standing still. It takes but a few moments to jot down the observations. The value of such notes, promptly forwarded to the proper officer, is often of great importance. These written records frequently are of use in lawsuits arising from fire claims, months after the occurrence. When it is generally known that a railway company requires such records kept, the number of fire claims will dwindle perceptibly.

When a fire occurs in spite of all precautions, prompt investigation with disinterested witnesses is of the utmost importance. Many suits against railway companies are lost by the railways because of lack of prompt investigation and proper witnesses. All officers and employees who observe fires or danger of fires and who are not able to do active service in remedial work on account of other duties should immediately report the observation to the nearest section foreman and operator. It should be the operator's duty to report at once to the chief despatcher. It is the section foreman's duty to get to the fire or danger with his men, car and tools as quickly as he can, whether on his section or the adjoining section.

Night fire patrols result in much benefit in times of stress. Extra gangs may work a certain number of men at night, with train and extra train crew to good advantage. Night track walkers are frequently necessary on account of fire danger.

Old ties should not be burned in dry weather. No more than 40 to 50 ties should be piled together for burning, nor should any such fire be allowed to burn after night. To this end all tie fires should be lighted early in the morning and quenched with earth or otherwise in the afternoon.

Close watching, well organized and faithfully carried out is more than half the battle.

THE PRACTICE ON THE VARIOUS RAILROADS

That "an ounce of prevention is worth a pound of cure" is an axiom which cannot be improved upon, when considering the subject of fire prevention, and it is the practice of railroads generally to take precautions which will tend to prevent the starting of fires from the sparks from locomotives, abandoned fires on the right-of-way, discarded cigarettes, etc. On many roads the measures taken are outlined in printed circulars. In some cases it has been found advantageous during periods of dry weather, to send out these circulars repeatedly, warning the section foremen of the precautions which the dry weather makes especially necessary. On the Illinois Central inspections are made semi-annually by a fire inspector and various maintenance officers.

Vigilance in fire prevention must be directed toward two definite ends, one to eliminate as far as possible all sparks or other sources of fires, second to put the right-of-way and its contents in such condition that they offer a poor field for the starting of a fire from any source.

To eliminate sparks, every effort must be made to keep front-end screens in good condition and to enforce strict rules for the operation of ash pans. The condition of

spark arrestors on the Bangor & Aroostook is checked by requiring the section foreman to include in his fire report message the words "examine ash pan of engine ...." or "examine netting on engine ....," in any case where he believes that the fire was started from either of these sources. Roads in the southwest find that the fire hazard is very much less in the case of locomotives burning oil as a fuel. On 485 miles of main track on the Canadian Pacific operated by oil-consuming locomotives, in no case has a fire been attributed to the locomotives.

The most favorable condition for the starting of fires from sparks or other sources is obtained when the grass and other vegetation on the right-of-way is dry enough to burn. From this follows the general practice of cutting or burning the vegetation on the right-of-way just as soon as it becomes dry enough to make it necessary or desirable. On the Chicago & North Western it has been found expedient to mow the right-of-way at about the time that the small grains mature in the adjoining fields.

On the Union Pacific it is customary to require the track laborers to remove the shocks of grain to a distance of at least 250 ft. from the tracks during the time that the grain is being cut. Weeds on the right of way are cut, beginning about the middle of June, the work being done by the track forces, assisted by teams and men hired in the locality. As soon as the weeds are dried sufficiently they are burned whenever the direction of the wind permits.

Fires in the vicinity of wooden bridges or trestles are especially dangerous because of the opportunity for the destruction of the bridge. This makes it imperative to keep all weeds, brush and rubbish away from the supports for such structures. It is, of course, a universal rule to provide water barrels and keep them full.

Outside Assistance

The railroads must not only organize to obtain the requisite vigilance on the part of their employees, but a certain amount of co-operation with the adjoining property owners and governmental authorities is also requisite to secure the desired end. As the sparks from locomotives may be oftentimes carried beyond the right-of-way, the burning of grass inside the fence line does not always suffice. For this reason some roads have endeavored to obtain permission from the farmers to burn grass or plow furrows in the adjoining fields at a sufficient distance from the track to prevent fires. Occasionally it is possible to get the farmers to do a portion of this work themselves. Sometimes they are given old ties suitable for firewood as payment for this work. This co-operation is not always readily secured, for, in the words of one railway officer, "there are some owners of property adjacent to railroad track who will not agree to anything which would reduce the value of their holdings as sources of claims for damage alleged to have been caused by locomotive operation."

State Regulation

Some states have laws which are designed to assist the railroads in their efforts to prevent fires. Such a law was passed in the state of New Jersey in 1909, which required that a strip 10 ft. wide and 100 ft. from the nearest rail must have every particle of vegetation of inflammable nature removed, and that between this safety belt and the railroad the ground was to be cleared of grass and brush by mowing or burning or both, while trees were to be trimmed of branches six feet above the ground. Unfortunately this law was declared unconstitutional, but the Pennsylvania Railroad continues to carry out the spirit of this law wherever it can obtain the voluntary co-operation of the property owners.

The laws of New Jersey also require that a permit be issued by a fire warden to burn old ties, grass, etc., on the right of way. For the sake of convenience in applying this law the Lackawanna has had its section foremen appointed fire wardens to serve in that capacity without any additional compensation.

The Dominion of Canada has very extensive regulations governing matters such as the use of fire protective appliances on locomotives, the regulation of fuel, the construction and maintenance of fire guards, the clearing of right of way, and the establishment of a special patrol of the railway lines in the forest sections from April 1 to November 1, as specified by the chief fire inspector of the Board of Railway Commissioners. Each year the chief fire inspector of the board issues a circular prescribing the fire guard requirements in the prairie provinces and also issues a statement setting forth the fire patrol required. The government has inspectors on duty to see that these requirements are complied with. The regulations also cover the manner in which a track in forest sections shall be patrolled, but the inspectors have the power to waive the patrol when the conditions make it unnecessary.

The state of Maine has a law providing for the appointment of chief fire wardens and deputy wardens, some of the latter being assigned to patrol the tracks of all the railroads in the state the salaries of such wardens being paid by the railroad companies. The Bangor & Aroostook has been able to increase the efficiency of this system through a plan whereby the railroad hires these men subject to the approval of the deputy fire warden, the men being employed in the section gangs at such time as there is no danger of fire. It is the duty of these deputy fire wardens to patrol the railway track and watch for fires which they fight, whenever discovered, with the assistance of track forces.

Fire Fighting

Having taken every precaution to prevent the starting of fires, the next important provision is for the discovery of the fire at the earliest possible moment after it starts. This is carried out by patroling the track by special officers as in the case of the state of Maine or by the regular track forces. Ordinarily this work is necessary only at such times or periods when the vegetation is in a condition to ignite readily. The train and engine crews are commonly enlisted in this work by instructing them to notify the section foremen as they pass by of any fires that they have noticed in coming over a section. On some roads this is facilitated by furnishing the engine and train crews with what are known as fire cards which are thrown off to the section crews or station agents, with blanks filled out to show the location of the fire.

The actual fire fighting must be done by the track forces except in such cases where the fire is sufficiently close to engine terminals or shops to permit the mechanical forces to be called out. Section foremen are always instructed to disregard their section limits in cases of fire and to send their crews on to adjoining sections whenever necessary.

Water ordinarily not being available, the fires must be extinguished by beating with limbs of brush or wet sacks tied to the end of a shovel. Where the vegetation is thin, it is often possible to throw sand or dirt on the fire. On the Pennsylvania Railroad ballast forks are found to be effective in the pine woods of the Delaware sand plains, while water alone is effective among the rocks of the Pennsylvania hills. Whenever a fire assumes dangerous proportions it may be necessary to plow a furrow at the head of it and burn back on the windward side of the furrow.

In Canada each patrolman in fire inspection service is required to have one shovel and one canvas bucket. Patrolmen equipped with velocipedes or power cars are required to have two shovels, two buckets and one ax, and in addition each regular section gang must be equipped with an ax, two mattocks and four buckets, to be stored in the tool house.

On the lines of the Southern Pacific in the Sierra Nevada mountains, where it is necessary to protect the snow sheds, four special fire trains are maintained fully manned and always under steam. All switch engines of this company are equipped with fire hose and either pumps or inspirators, and it is the practice to keep tank cars filled with water at a number of central points to be used in connection with the switch engines.

ADMINISTRATION OF CLAIMS

As claims are almost invariably presented against the railroad company for a fire which takes place within any reasonable distance of the right of way, it is necessary that the claim department be furnished with all available information relative to the nature of the fire, the circumstances surrounding its occurrence which would throw any possible light on its cause and a thorough inventory of the extent of the damage. To this end the section foremen are required to make out reports of fires on blank forms designed to guide them in giving the necessary information. In some of these reports, aside from calling for all possible evidence as to the cause of the fire and the extent of the damage, an opportunity is given for the foreman to give his personal opinion as to these questions. At the same time the foremen are usually cautioned not to give out any information particularly as to the cause of the fire to unauthorized persons.

On the Pennsylvania Railroad more expert data is obtained in the case of forest fires by requiring the forester to appraise the damage. This results in a forest survey for the purpose of ascertaining the composition of the wood with figures on the rate of growth, volume and yield in material and money. If a settlement is not made the man who made the appraisal may be called upon to testify as an expert in any suit leading from the damage claims.

On the Union Pacific the precaution is taken to measure and locate all hay and grain stacks within ½ mile of the track on both sides of the right of way. Thus accurate information is available in advance of any fires. On the Canadian Pacific a rough sketch of the general location of fires accompanies the evidence gathered. If it is concluded that the company's liability is clear, steps are taken to ascertain if the claimant carried any insurance and the amount of compensation recoverable from the company is reduced by the amount of insurance carried. The value of the property lost is also estimated very closely, taking into account the market price in the case of grain and deducting the cost of cutting, thrashing and marketing. The Southern Pacific maintains a very close account of fire losses. Out of a total of 214 occurring during 1914 the company was charged with having caused 64 per cent and credited with extinguishing and assisting to extinguish 83 per cent. Of the total loss from these fires, 71 per cent fell upon the company in the form of claims paid or from the destruction of fences, ties and other company property.

Considerations in Guard Rail Design

BY JAMES G. WISHART,
Office Engineer, Chicago, Rock Island & Pacific, Chicago, Ill.

THE diversified details and dimensions of frogs, switches, guard rails, etc., adopted by different railroads or advocated by the various manufacturers, have resulted in a direct increase in the cost of these articles to the railroads and in delays in deliveries. These delays are especially noticeable when orders are placed during rush periods in the manufacturer's shop. This variation in design is specially prominent in the standard plans of guard rails which have been adopted by the various railroads. Lengths varying from 7 ft. 6 in. to 25 ft. are in actual use at the present time. The 15-ft. length has been the most commonly used, with the 10 and 11-ft. lengths gaining in favor since the adoption of 33-ft. rails. The shorter lengths of 7 ft. 6 in. and 8 ft. 3 in., while of comparatively recent design, are proving equally as efficient in the track as the longer ones. Their cost is a third less and a greater number are obtainable from the same quantity of rail. The method of fastening the guard rail in its proper position also varies to a great extent. Combinations of from four to eight bolts with solid or adjustable fillers and with the addition in some cases of one or two guard rail clamps, are in common use.

There is apparently no good reason for such a wide divergence of practice. The principal reason is probably personal equation, or possibly a desire for individuality, on the part of those responsible for the plans on the different railroads. It would appear as a reasonable assumption that a track appliance which proves itself satisfactory for one railroad whose equipment and volume of traffic are above the average, should serve equally well on any other road in the same section of the country.

A guard rail is defined by the track committee of the American Railway Engineering Association as "A rail or other device to guide the wheel flange so that it is kept clear of the point of frog." This describes briefly and definitely the principal function of this appliance. The frog point itself is protected by the straight portion, generally placed in the center of the guard rail, the wheel flanges being drawn gradually to the proper position, relative to the frog point, by the flared portion at each end. The wheel flange should also be guided across the diverging throatways immediately ahead of the point. Therefore, the distance from the point of frog across this diverging throatway to the point where the flangeway is of normal width is what governs the length of the straight portion in the center of the guard rail.

This distance varies from 13½ in. in a No. 6 frog to 45 in. in a No. 20 frog. As very few frogs of a flatter angle than No. 11 are in general use, it would appear that a guard rail with a straight center portion 30 in. in length is ample to protect all frogs up to a No. 11, and one with a straight center portion 39 in. in length for all frogs up to a No. 16. As frogs of an angle flatter than a No. 16 are more or less of a special character and are used only in very high speed turnouts; they should be protected by specially designed guard rails.

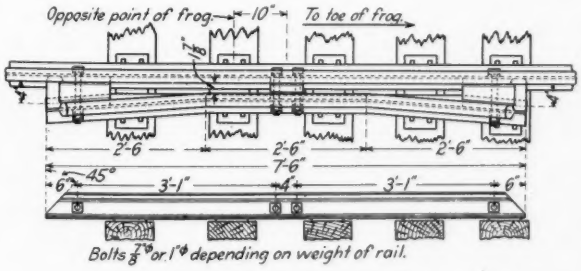
The flare ends should be straight, not curved, and the angle of divergence as flat as practical. The distance of

4 in. between the heads of running and guard rails at the end of the guard rail is ample to give proper and safe clearance for the wheel flange when entering the guard rail flangeway and a length of 2 ft. 6 in. along the flare produces a rate of divergence of approximately 1-16 in. in 1 in. The straight flare end offers less resistance to the moving wheel flange than a curved one and consequently makes a smoother riding guard rail. The 2-ft. 6-in. flare ends with a 30 or 39-in. center straight portion provide a guard rail that will give ample protection and is an economical length.

The accompanying plans of guard rails have been designed with the above objects in view, the lengths being such that 4 of the 8-ft. 3-in. lengths may be cut from a 33-ft. rail and 4 of the 7-ft. 6-in. lengths from a 30-ft. rail. This, of course, will not work out in every instance as shorter length rails may at times, for special reasons, be more desirable for this purpose. Assuming that 33-ft. rails are of the heavier sections and consequently in use in main tracks where there is a heavy traffic, the 8-ft. 3-in. guard rail shown was designed with an adjustable center filler and heavy yoke or clamp. By means of the adjustable filler, 1⅛ in. of side wear on the head of the guard rail can be taken up or the flangeway can be widened where turnouts are installed on sharp curves and the curvature is carried by the frog point and the gage is widened.

The clamp as a guard rail fastening is rapidly gaining in favor, every year adding to the number of additional companies who approve its use. The strength of these clamps is such that bolts at the center of the guard rail or rail braces are unnecessary except in extreme cases. The heavy yoke of heat-treated steel or refined iron as designed at the present time, gives a maximum strength at the point where the greatest holding power is required. An extremely low percentage of clamp failures has been recorded since the introduction of the modern designs. The lateral thrust of the wheels tends to overturn the guard rail and to overcome this with bolted guard rails the rail brace is often resorted to with indifferent success. The clamp overcomes this difficulty without the aid of rail braces.

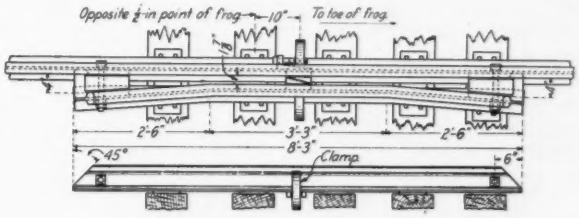
The ease with which guard rails with clamps are installed is another point in their favor. The design shown is applied with the drilling of but two holes in the main rail, a pair being applied easily in one-half hour by three men. The proper method of applying the clamp should



THE 7-FT. 6-IN. GUARD RAIL

be strongly impressed on the trackman, as this appliance is not fool-proof, although its proper application is simple. The points to be observed are: first, its position relative to the frog point, that is, 10 in. ahead of it or toward the toe of the frog; second, its position with relation to the running rail, that is, at an angle of 90 deg. to the gage line, and third, to see that all fillers are tight, this being accomplished by driving the wedge filler in firmly and inserting the fastening to prevent retroaction. The end fillers are of cast iron and are designed to serve as foot guards as well as separators. The bolts through these fillers should be of the diameter shown in the table and to withstand the excessive stresses caused by blows from wheel flanges traveling at high rates of speed, should have a tensile strength of not less than 100,000 lb. per sq. in. and be made of a special alloy or heat-treated steel.

The 7-ft. 6-in. guard rail shown is designed on the theory that 30-ft. rails are of the lighter sections and are



THE 8-FT. 3-IN. GUARD RAIL

consequently used in a majority of cases where the traffic is comparatively light, principally in side tracks. For this class of service the two bolts at the center are generally satisfactory and efficient as a means of holding the guard rail to gage and at a lower cost than the clamp. These bolts as well as those at the end should be made under the same specifications as those for the 8-ft. 3-in. guard rail. The solid center filler does not allow of any variation in the width of the flangeway and in cases where such adjustments are necessary, the clamp and adjustable filler should be used. In cases of heavy traffic the clamp should be applied in place of the center bolts.

Plates ⅝ in. thick and 8 in. wide should be used on all ties with both of the designs shown. These plates are a material aid in holding the rails to proper gage as well as protecting the switch ties.

The standard distance between backs of wheels as adopted by the Master Car Builders' Association is 4 ft. 5⅛ in. The distance from the gage of the running rail to the back of the wheel, when in normal position, is 1 11-16 in. Allowing 3-16 in. for the clearance between the back of the wheel and the inside face of the guard rail, a flangeway of 1⅞ in. is required. This makes the distance between inside faces of guard rails 4 ft. 4¾ in., and this distance must be maintained in all cases. If the track gage is widened at the frog point, the full amount of widening must be added to the guard rail flangeway, as the flangeway in the frog cannot be altered. If this is not done derailments will occur. Many trackmen do not appreciate the importance of this rule and it should be strongly impressed on them when the adjustable fillers are adopted.

The designs presented herewith are thought to be economical, both in construction, installation and maintenance, and to fulfill all requirements.

Uniform standards for frogs, switches, guard rails and other track appurtenances if adopted by all the railroads of the country, or even by groups of railroads purchasing track material at a common market, will result eventually in material economies both for themselves and for the manufacturers.

"Hopping" Trams—Through its safety committee, the Nashville, Chattanooga & St. Louis has inaugurated a campaign against "train hopping." Within the past two weeks two boys have been crippled while trying to catch rides on freight trains of this railroad. Arrests have proved only a temporary preventative.

RAILWAY ENGINEERING ASSOCIATION WORK

The Subjects Assigned to the Committees for Investigation This Year with the Chairmen of Committees

THE work outlined for the various committees of the American Railway Engineering Association for the ensuing year, together with the chairmen of the different committees, is given below. Although this schedule has just been announced in its entirety, the different committees were advised of the subjects assigned to them for investigation some time ago and they are now actively engaged in their work. As will be noted, a number of these subjects will necessarily be continued over more than one year and it is not expected that complete reports will be presented upon all of them at the approaching convention.

1. ROADWAY

W. M. DAWLEY, assistant engineer, Erie, New York, N. Y.

Continue the study of unit pressures allowable on roadbeds of different materials, co-operating with the special committee on Stresses in Railroad Track.

Report on the prevention and cure of water pockets in roadbed.

Report on advisable slopes for high rock cuts 40 ft. in height or more.

Report on advisable width for newly-constructed roadbeds on high embankments of 50 ft. or more.

Report on the advantages and disadvantages of track elevation and track depression in cities where many street crossings make it necessary to change the grade of the railway.

Report on the advantages and disadvantages in depressing or elevating streets where a few crossings are to be eliminated with but slight changes in the grade of the tracks.

Report on the effect of fast trains on the cost of maintenance of way and maintenance of equipment.

2. BALLAST

H. E. HALE, group engineer, Presidents' Conference Committee on Valuation, New York City.

Report on ballast sections, with particular reference to the use of sub- and top-ballast.

Define sub- and top-ballast.

Report on the proper depth of ballast of various kinds to insure uniform distribution of loads on the roadway, conferring with the special committee on Stresses in Railroad Track and the committee on Roadway.

Report on methods and cost of applying ballast, with especial reference to the following plans: (a) Organization of the most economical ballast gang of railway company forces. (b) Use and limitations of mechanical tools, such as the pneumatic tamper and spreader for forming shoulder and path. (c) Application by contract.

Report on the comparative merits of different stones and gravel and other materials for ballast.

3. TIES

L. A. DOWNS, general superintendent, Illinois Central, New Orleans, La.

Continue the study of the effect of the design of tie-plates and track spikes on the durability of cross-ties.

Submit specifications for cross- and switch-ties: (a) When used without preservative treatment. (b) When to be used with a preservative liquid.

Report on trials of metal, composite and concrete cross-ties, and give results to date.

Report on future timber supply for ties, both domestic and foreign.

4. RAIL

JOHN D. ISAACS, consulting engineer, Southern Pacific, New York City.

Submit definite recommendations for changes in the Manual, giving special attention to the rail designs recently adopted, and to the specifications for carbon steel rails and joint bars.

Present annual statistics of rail failures and draw conclusions therefrom.

Report on the effect on rails of defective equipment and improper maintenance.

Continue the special investigation of rails.

Report on track bolts and nutlocks.

Report on details of manufacture and mill practice as they affect rail quality.

Make a critical study of joint bars from the standpoint of design and material, together with laboratory tests, including strain gage measurements, after having established a uniform method for comparative testing.

Report on the relative values of material for joint bars, quenched only versus quenched and tempered, and whether it is most advantageous to quench in oil or water.

Report on the rational relation between the intensity of pressure due to wheel loads and the resistance of rail steel to crushing and deformation.

Continue the investigation and development of methods of inspection.

Report on federal and state commission rulings.

5. TRACK

G. J. RAY, chief engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Continue the study of the economics of track labor.

Report on specifications and submit designs for cut- and screw-spikes.

Report on guard rails and flangeways and the effect of an increase of ⅛ in. thickness of wheel flanges.

Report on typical plans of turnouts, crossovers, slip switches and double crossovers, and prepare detail plans for such work, including such incidentals as tie plates, rail braces, riser plates, etc., conferring with the committee on Signals and Interlocking.

Report on the design of and specifications for manganese frogs and crossings.

Report on the reduction of taper of tread of wheels to 1 in 38 and on canting the rail inward.

Confer with the committee of the Master Car Builders' Association with a view of reducing the present allowable limit for flat spots on freight car wheels.

Report on the test of tie plates subject to brine drippings.

Report on the limit of wear on the rail head on curves.

Report on specifications for relayer rail for various uses.

Report to the extent the frog and switch designs recommended by the Association are being used by railways.

Report on definition of "main track."

6. BUILDINGS

M. A. LONG, assistant to chief engineer, Baltimore & Ohio, Baltimore, Md.

Report on coaling stations.

Report on freight house and passenger station scales.

Report on ash pits.

Report on a classification of buildings on the basis of "Specification-Types" and upon the use of the "cubic foot," "square foot," and "bill of particulars" methods for ascertaining the approximate cost of new construction.

Report on safety tread devices for stations exposed to the elements.

Report on the general subject of roadway buildings.

Report on the design and merits of high and low platforms at passenger stations.

Report on the design of shop buildings.

Report on comparison of "umbrella" versus "butterfly" sheds at through stations.

7. WOODEN BRIDGES AND TRESTLES

E. A. FRINK, principal assistant engineer, Seaboard Air Line, Norfolk, Va.

Report on the design of docks and wharves, including floors; likewise coal and ore wharves.

Report on the comparative merits of ballast deck and reinforced concrete trestles, taking into consideration the design of ballast floors for timber trestles.

Continue the study of the use of lag screws in trestle construction.

Report on the classification of wooden bridges.

Report on the merits of galvanized iron fastenings for timber trestles as compared with plain iron and steel fastenings, especially in relation to their use on creosoted structures.

8. MASONRY

F. L. THOMPSON, assistant chief engineer, Illinois Central, Chicago, Ill.

Report on the cost and method of constructing concrete piles, and make recommendations on how and where to be used. Present additional typical designs for concrete piles for different

loading and rules for driving under various conditions and loading.

Report on the cost, appearance, and wearing qualities of various methods of surface finish for concrete.

Report on typical designs of foundations for piers, abutments, retaining walls, and arches in various soils and depth of water (not including pneumatic foundations).

Report on principles of design of plain and reinforced retaining walls and abutments.

Report results of work with the joint committee on Standard Specifications for Cement.

Report results of work with the joint committee on Concrete and Reinforced Concrete.

Report upon the wisdom of the use of blast furnace slag in reinforced concrete work, taking into especial consideration its probable duration.

9. SIGNS, FENCES AND CROSSINGS

W. F. STROUSE, assistant engineer, Baltimore & Ohio, Baltimore, Md.

Report on the subject of "Signs" and the principles of design and rules for their use.

Report on the concrete fence posts.

Report on the reduction of the number of roadway signs and the adoption of a standard sign for general use as far as possible. Study in this connection, in collaboration with the committee on Signals and Interlocking, the design of suitable day and night (if necessary) markers or signs for switch signals, derail switches, stop posts, slow posts, resume-speed posts, water station and track-pan markers, highway crossing signals, etc. Also consider the location of signs, having in mind the matter of safety of employes obliged to use the roadway.

Report on legal requirements relative to the provision of fences for right-of-way and of stock-guards.

Report on the classifications of fences into "types."

Make a comprehensive study of crossings: (a) Grade crossings: Crossing gates, crossing signal bells, warning signals, watch houses.

(b) Overgrade and undergrade crossings: Study the laws of the various states which affect the distribution and cost between the carrier and the public. Study the economic design of overhead bridges to meet the requirements of public service commissions and other governmental bodies.

10. SIGNALS AND INTERLOCKING

C. C. ANTHONY, assistant signal engineer, Pennsylvania Railroad, Philadelphia, Pa.

Continue the study of economics of labor in signal maintenance.

Report on the problem of signaling single track roads with reference to the effect of signaling and the proper location of passing sidings on the capacity of the line.

Report on specifications adopted by the Railway Signal Association, which, in the judgment of the committee, warrant consideration, conferring with the committee on Track on any appliances affecting track.

Report on requisites for switch indicators, including method of conveying information as to the condition of the block to the conductor and engineman.

Report on the desirability of having an overlap in automatic signaling; if so, is it best to have two stop indications between trains or two caution indications instead, or the latter in special cases only, such as on downgrade tracks?

Report on the various methods of giving signal indications other than by means of the semaphore (this includes the light signal for day and night indications).

Report on the feasibility of separating into distinct types of their own (1) the signals for train operation, and (2) the markers or signs which indicate the location or position, or both, of information signs and switch signals for conveying information to trainmen. The semaphore is now almost universally used for governing train operation, therefore design suitable day and night (if necessary) markers or signs for switch signals, derail switches, stop posts, slow posts, resume-speed posts, water station and track-pan markers, highway crossings, signals, etc., conferring with the committee on Signs, Fences and Crossings.

Analyze the signal schemes which have been presented to the Association. State specifically for what purpose each aspect and indication shall be used and what action on the part of the engineman is required.

Report on automatic train control.

Report on the comparative merits in various locations of alternating current and direct current for operation of automatic signals.

Report on applications of aspect for instructions to trains to take siding at a non-interlocked switch.

11. RECORDS AND ACCOUNTS

W. A. CHRISTIAN, senior civil engineer, Division of Valuation, Interstate Commerce Commission, Chicago, Ill.

Report on the use of small forms on cardboard or other suitable material for use of field men in making daily reports, to the end that supervision may be facilitated and efficiency encouraged.

Report on the Interstate Commerce Classification of "Investment in Road and Equipment" and "Operating Expenses" and report on any desirable changes.

Report on the various methods of reproducing maps and profiles on tracing linen for permanent record.

Report on the problem of recording and reporting the cost of additions and betterments.

Submit specifications for maps and profiles, co-ordinating with previous work of the Association.

Report on the valuation forms now in use and recommend forms for both field and office use.

12. RULES AND ORGANIZATION

C. DOUGHERTY, chief engineer, Queen & Crescent, Cincinnati, Ohio.

Prepare a "Manual of Instructions for the Guidance of Engineering Field Parties."

Continue the study of the science of organization.

Prepare a "Manual of Rules for the Guidance of Employes of the Maintenance of Way Department."

13. WATER SERVICE

A. F. DORLEY, engineer maintenance of way, Missouri Pacific, St. Louis, Mo.

Make a final report on the design and relative economy of track pans from an operating standpoint.

Report on methods for rejuvenating driven wells and the cost and success, as compared with driving new wells.

Report on the various types of well strainers in use and the service secured from each type.

Report on methods for complying with Federal regulations in regard to purity of drinking water supplied to the public and employes on interstate trains.

Report on designs of impounding reservoirs, and the conditions under which they are economical.

Report on the relative merits of continuous and intermittent water softeners.

Report on rules or examination questions for the care of boilers in pumping stations.

14. YARDS AND TERMINALS

E. B. TEMPLE, assistant chief engineer, Pennsylvania Railroad, Philadelphia, Pa.

Report on the handling of freight in double-deck freight houses and the cost of operation.

Continue a study of typical situation plans for passenger stations and approaches and on methods of their operation.

Report on classification yards.

Make a final report on track scale specifications.

Report on a suitable profile for hump yards.

15. IRON AND STEEL STRUCTURES

A. J. HIMES, engineer grade crossing elimination, New York, Chicago & St. Louis, Cleveland, Ohio.

Report on methods for the protection of iron and steel structures against corrosion.

Report on the relative economy of various types of movable bridges.

Report on secondary stresses and impact.

Report on column tests.

Report on the design, length and operation of turntables.

Report the present practice in construction of ballast-floor bridges and methods in use for waterproofing the same.

16. ECONOMICS OF RAILWAY LOCATION

JOHN G. SULLIVAN, chief engineer, western lines, Canadian Pacific, Winnipeg, Man., Can.

Report on the resistance of trains running between 35 and 75 miles per hour.

Report on the effect of curvature on the cost of maintenance of way and of the maintenance of equipment.

Report on the effect of train resistance on the amount of fuel consumed.

After the study of the effect of the various physical characteristics of railroad locations upon their economy of maintenance and operation has been made, if it is possible to do so, state the conclusions derived from these studies in a formula, or series of formulas, which can be used by engineers in determining the relative efficiency of various locations.

Report on the entire question of economics of location as effected by the introduction of electric locomotives.

Report on the extent the locating engineer is justified in making additional expenditures in getting nearer to medium-size centers of population already in existence in the territory where the road is to be built.

17. WOOD PRESERVATION

EARL STIMSON, engineer maintenance of way, Baltimore & Ohio, Baltimore, Md.

Report on water in creosote.

Report on the relation of the amount of preservative and the depth of penetration to the resistance of materials against decay, and also the penetration of preservatives.

Report service test records, extending them to include structural timbers.

Report on the drying process in wood preservation.

Report on methods of accurately determining the absorption of creosote, and upon the temperatures used in the creosoting process.

Report on the results of the exposure tests of material treated with water gas tar.

18. ELECTRICITY

GEORGE W. KITTREDGE, chief engineer, New York Central, East of Buffalo, New York, N. Y.

Report on the subject of clearances of third rail and overhead structures, conferring with other committees.

Report on the study of electrolysis and insulation and its effect upon reinforced concrete structures.

Report on the study of maintenance organization, and relation to track structures.

Report on the proper type of overhead catenary construction, with particular reference to the consideration of providing clear vision for signals, co-operating with committee on Signals and Interlocking.

Report on water power for electrical railway operation, in collaboration with committee on Conservation of Natural Resources.

Report recommended practice for eliminating, as far as is practicable, the interference with telephone and telegraph circuits caused by the use of 25-cycle propulsion circuit.

Report on the interference with telegraph and telephone circuits caused by the use of a direct-current propulsion circuit and methods of eliminating this effect as far as is practicable.

Continue co-operation with national joint committee on Electrolysis and the national joint committee on Overhead and Underground Line Construction.

19. CONSERVATION OF NATURAL RESOURCES

R. C. YOUNG, chief engineer, Lake Superior & Ishpeming, Marquette, Mich.

Continue the study of tree planting and general reforestation.

Report on developments in methods of lumbering and forestry tending to prolong the timber supply.

Collect statistics on extent of use of treated timber and of permanent materials to replace untreated timber and bare steel.

Report on the conservation and utilization of water power for railway purposes, conferring with Committee on Electricity.

Report on the study of coal, fuel-oil, timber, iron and steel resources.

Report on the relation of railways to the different conservation projects, reviewing work that has been done by each company up to the present time, and make recommendations on policies economical for railways to follow.

20. UNIFORM GENERAL CONTRACT FORMS

E. H. LEE, vice-president and chief engineer, Chicago & Western Indiana, Chicago, Ill.

Report on forms of agreements for industry tracks.

Report on forms of agreements for interlocking and railway crossings, conferring with the committee on Signals and Interlocking, including the rights and obligations of the interested companies.

Report on a form of agreement embodying rules governing the construction of undercrossings of railways with electrical conductors, conduits, pipe lines and drains, conferring with the committee on Roadway and the committee on Electricity.

Report on a form of lease agreement for industrial site.

21. GRADING OF LUMBER

DR. HERMANN VON SCHRENK, consulting timber engineer, St. Louis, Mo.

Report on classification and grading rules for all lumber and timber used in the construction and maintenance of way departments of railways.

Report on specifications for construction timbers and building lumber.

From these studies draw up in a unified form a set of specifications for construction timbers and building lumber for use on railways, showing each kind and quality of lumber or timber which is suitable for each of the different classes of work on a railway.

Report on specifications for timber which is to be treated with a preservative substance, co-operating with the committee on Wood Preservation.

22. STRESSES IN TRACK

A. N. TALBOT, professor of municipal and sanitary engineering, University of Illinois, Urbana, Ill.

Simple Methods of Collecting Scrap

BY J. B. BAKER,

Supervisor, Pennsylvania Railroad, Philadelphia, Pa.

ACCELERATION in all lines of business means an increase in worn-out materials for the scrap bins, and in no industry is this more marked than in railroad maintenance. Shop and maintenance scrap is generally centralized at points where electro-magnets

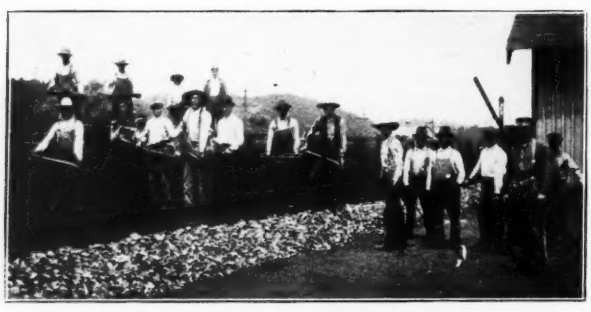


FIG. 1. LOADING SCRAP WITH SHOVELS

may be used to advantage, but to handle scrap at outlying points some means more economical than a magnet is desirable.

The customary procedure, as shown in Fig. 1, is to concentrate the discarded material in piles near mile posts, whistle boards or other distinctive locations, to be picked up by work-train gangs, who use ballast forks for small scrap and carry the larger pieces. It required three minutes from stop to start of the train for 17 laborers to load a ton of scrap in this manner.

On one of the main line divisions of the Pennsylvania Railroad a derrick, shown in Fig. 2, has supplanted this procedure. The derrick is a No. 3 American rail loader, operated by an air cylinder connected to the main reservoir of the locomotive. The safe capacity of the machine is about 4,000 lb. at a 26-ft. radius, which permits operation over an intervening track. The boxes to contain dirt or other material were made of 1¾-in. plank and are 4 ft. by 4½ ft., with two sides and a back 10 in. in height. One end is left open for ease in dumping when the ring which holds the finger of the front hook is struck upward, thereby releasing the single chain and causing the box to swing from the two chains hooked to rings in the ends of the reinforcing strap irons with which the boxes are bound. The contents having been emptied into a car, the box is swung back to its location on the ground and the chains released. To pick up a ton of

scrap in this way three laborers are necessary, though four may be used advantageously under certain conditions, as, for example, when loading from the low side of a curve. A ton or more of material may be loaded easily in two minutes' time from stop to start of a train. The comparative labor cost by these two methods is as follows:

By hand, 3 min. for 17 laborers @ 20 ct. . . $0.17 per ton
By boxes, 2 min. for 4 laborers @ 20 ct. . . 0.026 " "

Or a saving in labor of . . . . . $0.144 per ton

These figures do not include the cost of the compressed air furnished by the locomotive, or the cost of upkeep of the derrick. Interest charges on a machine already in use should not be considered in this service. The boxes were made from lumber previously used in concrete forms and cost $3.25 each, complete.

Ordinarily a derrick or rail loader is used almost exclusively for handling rail, and is therefore idle the greater part of the time, but is included in every-day work-train equipment for the purpose of delivering and picking up repair and wornout rail in small quantities. Therefore, comparative costs of handling scrap on the division by hand and by the use of a rail loader and boxes resolve into a comparison of the cost of labor and

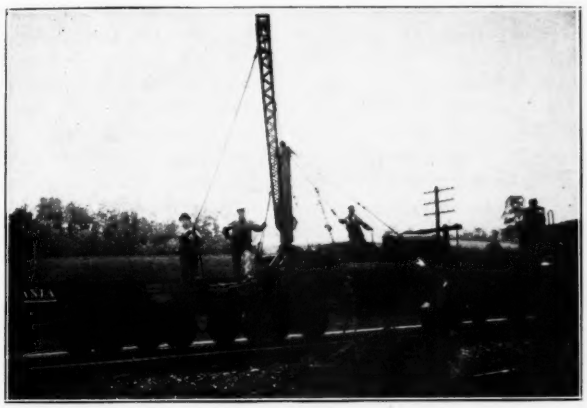


FIG. 2. LOADING SCRAP WITH A BOX

of air supply. As already shown, there is a difference of 14.4 ct. per ton in favor of the box method, based simply on the saving of labor hours required. This in itself should be sufficient recommendation for the addition of boxes and a chain where a rail loader is already in use. If, as observation seems to indicate, an actual reduction in time is to be expected in the loading of each pile of scrap, then the time of the work train engaged in this service will be reduced and a further saving accomplished.

Other uses for these boxes readily suggest themselves, and we shall mention but one, which has proved very satisfactory. In cleaning the ditches through a cut, the boxes were placed at the proper interval to accommodate the dirt immediately adjacent thereto, and when filled by the ditch gang were picked up by a derrick and piled on a car. Empty boxes replaced the loaded ones removed, and, when opportunity offered, the loaded boxes were emptied where additional fill was needed. In this particular case, with the easily-tripped chain, it was possible to deposit this dirt at a greater distance from the track than could have been done by men in one handling.

The pictures showing the handling of rough stone by the use of large tongs attached to the rail loader are easily understood, and suggest the advantages to be derived when handling one and two-man stone for riprap and protection from scouring around bridge piers and abutments. Many bridges have hand railings, and at other points features such as interlocking connections, terra cotta pipe, neat ditches and sod preclude the usual method of lifting the stone to the top of the car sides and letting it fall to the ground or into the water. Therefore, it may be necessary to resort to some such scheme as sliding the stones or other material down planks, probably requiring a man on either side to control their course. The

FIG. 3. LOADING STONE BY HAND

use of hooks, which may be tripped with the load hanging over the water will show a marked saving in the cost of handling fairly large rough stone. To some the greatest appeal of this method will be made through the safety feature, which is self-evident upon an examination of the picture showing four men lifting one stone into a flat car, and the thought of what might happen if the hands of one should slip or be pinched. The result of an accident when sliding stones down a plank from

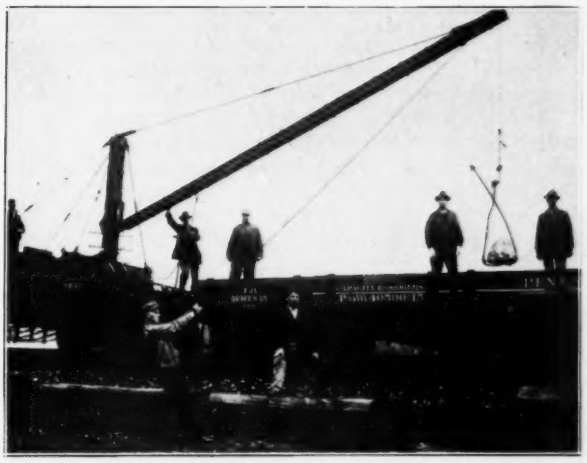


FIG. 4. PICKING UP STONE WITH A DERRICK

the height of a gondola car is likely to be more serious on account of the stone being above the men during part of its travel.

Machines such as the derrick shown in the pictures must come into pretty general use, owing to the rapidly increasing weight of track material and for other reasons. They are expensive, and, to show interest on the investment, should be kept in economical use and should not be allowed to remain idle awaiting the next rail-handling job.

The Crusher at Pearl, Ill.

THE Chicago & Alton has recently made extensive changes in its stone ballast plant at Pearl, Ill. The old crushing plant has been entirely rebuilt and extensive modifications have been made in the track arrangement in the quarry, with the result that a much more economical layout has been obtained than formerly existed. The purchase of about 20 acres of additional quarry land has added materially to the value of the quarry. Within 30 miles of this site a gravel ballast pit is being operated in the bed of a small stream, the method of operation being such as to obtain a considerable yardage of ballast at small cost. The layout and operation of these two plants embody a number of interesting features.

The rock at Pearl is a hard limestone, and, as developed at present, it presents a face about one-quarter mile long, with a maximum height of 125 ft. at the center, tapering off toward each end. The stripping is about 12 ft. deep at the center, decreasing to practically nothing at each end of the face. The limestone stratum is underlaid by a blue shale, which forms a suitable floor for the quarrying operations, the top of this shale being at an elevation of about 20 ft. above the grade of the Chicago & Alton main tracks, which pass by the nose of the hill in which the quarry is situated.

Advantage of this situation was taken in the location of the original crusher house by building it against the slope of the ground between the floor of the quarry and the track level, and this feature has been retained in the new layout. By placing the bins for the storage of the crushed stone only a sufficient elevation above the track level to obtain an efficient discharge of the stone into the cars, the vertical distance which it is necessary to elevate the stone from the crushers to the screens is approximately 20 ft. less than that which would have been required if the floor of the quarry and the tracks were on the same level. This arrangement is clearly seen in the photograph showing the crusher plant from the side of the loading tracks.

This is practically the only feature in which the old layout resembles the new one. In the old installation end-dump quarry cars were used, which approached the plant on a stub track leading to an incline, which elevated the cars to a tipple, where the rock was dumped into the crusher hoppers. The crushers were at a sufficient elevation to discharge by gravity into the screens over the bins. With this arrangement, power was expended for elevating the cars as well as the stone, and it also involved a hoisting engine with a man to operate it. In the new layout the crushers are placed at a sufficient elevation below the quarry tracks so that side-dump cars can unload the rock directly into the crusher hoppers, the rock alone being elevated to the screens by an Allis-Chalmers bucket elevator belt.

There are two crushers, each of which is placed in position to receive rock from the quarry cars, but ordinarily only one of them, a No. 6 Gates gyratory crusher, receives stone from these cars, a No. 5 crusher of the same make serving as a tailing crusher to which the rejects from the screen are spouted. The rock from the crusher is elevated, as previously noted, and passed through an Allis-Chalmers cylindrical screen 20 ft. long by 48 in. in diameter, which is divided into three sections having holes 1¼ in., 1¾ in. and 2½ in. in diameter, respectively. The section with the smallest holes is surrounded by a dust screen seven feet long having holes ⅜ in. in diameter The material passing this dust screen is collected in a small dust bin, while three large bins are provided for the storage of the stone passing the 1¼, 1¾ and 2½ in. holes, respectively. The power plant contains two 125-hp. locomotive boilers, a two-stage air compressor and a 35-hp. steam engine.

The arrangement of the tracks at the crusher can be seen in the photograph showing a birdseye view of the plant. The cars pass around a loop in going by the crusher dump, this loop being connected with the tracks of the quarry so that the cars always pass the crusher in the same direction. Twenty spur tracks are provided along the face for the collection of the stone which is loaded into 2 1-16 cu. yd. side-dump cars built for 3-ft. gage tracks.

About 80 men are normally employed in the quarry, the force being divided into two groups: the car loaders, who are employed on a piece work basis, and a plant force on a daily or monthly basis. The force is as follows:

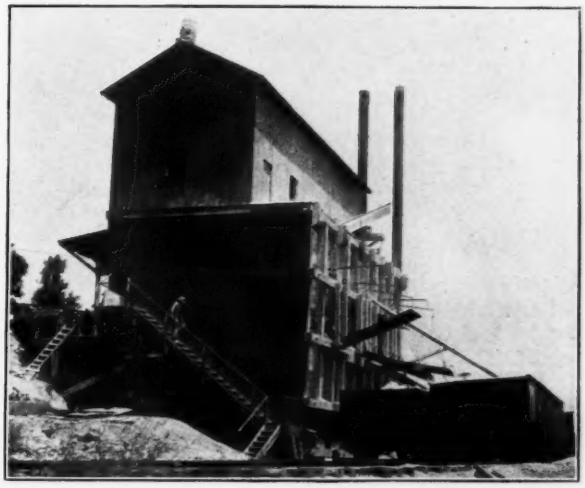
1 superintendent	$89.00 per month
1 timekeeper	53.00 per month
1 engineer	75.00 per month

1 fireman	57.00 per month
1 coal passer	1.75 per day
2 feeders and 1 machine man	2.10 per day
1 ballast car loader	2.10 per day
1 car loader's helper	1.75 per day
1 powder man	2.40 per day
1 powder man's helper	1.75 per day
1 night watchman	1.75 per day
1 car dumper	2.10 per day
2 air drillers	2.40 per day
2 drillers' helpers	1.75 per day
1 plug drill man	2.10 per day
1 "yardmaster"	2.10 per day
1 switch boy	1.50 per day
1 water boy	1.50 per day
2 track men and 6 laborers to clean ledges	1.75 per day
1 quarry car repairer	2.50 per day

In addition to this force, 40 men are employed loading stone into the quarry cars at 16½ cents per cu. yd. The quarry was reopened about June 10, and the average output since that date has been about 350 cu. yd. per day. It is anticipated that this will be increased to about 450 cu. yd. as soon as the work can be properly organized.

The rock is shot down from holes drilled along the face about 5 or 6 ft. apart with an average depth of about 32 ft., the distance from the face varying with the conditions. A typical charge for one hole is 50 lb. of 60 per cent dynamite, 75 lb. of black powder and two 30-ft. electric exploders. A considerable portion of the rock comes down in pieces too large to handle, so that it is necessary to shatter them by charges placed in holes drilled with a plug drill or by "adobe shooting." About 5,000 lb. of dynamite, 150 cans of black powder and 300 electric exploders are used each month for the ledge shooting, and about 100 lb. of dynamite and 100 caps and 150 ft. of fuse are used for shattering the large stones.

The output of this quarry is ordinarily divided into three grades—dust, concrete stone and ballast. The ballast is made by mixing the stone from the 1¾ and 2½ in. screens. The concrete stone is that passing the 1¼-in. screen and the dust is that passing the dust ring. The latter is used for station platforms, foot paths, etc., and a considerable amount is sold for fertilizing purposes. The concrete stone is also used occasionally in ballast by mixing it with the ballast stone. The plant has not been in operation a sufficient length of time to determine over just what territory the stone will be used. It will serve all of the Western division of the Alton and will probably be used extensively also in the direction of Bloomington, Ill., and St. Louis, Mo., east and south of Roodhouse, Ill., respectively.



THE CRUSHER FROM THE TRACK SIDE.

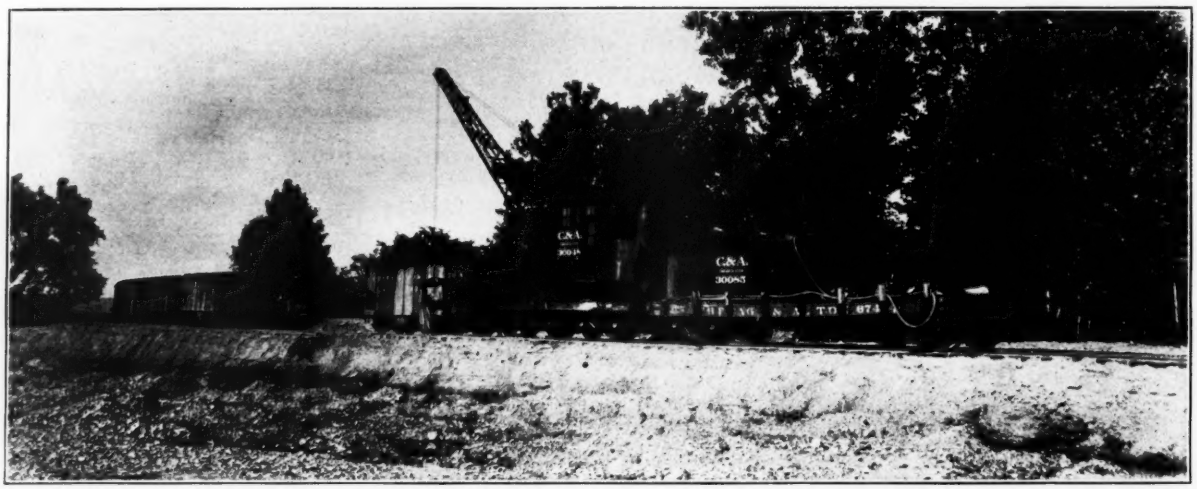
THE GRAVEL BALLAST PLANT

The gravel pit is located about five miles west of Louisiana, Mo., on Noix creek. At the site of the pit the water gradient is relatively flat, but further up stream the creek comes out of the hills where the water grade is steep and the flow rapid. Whenever a heavy rain storm causes the runoff of a large quantity of water, gravel picked up in the hills by the rapid flow of the water is deposited in the lower reaches of the stream where the

THE FACE OF THE QUARRY.

flow is less rapid. As a result the material removed by the pit operations is replaced from time to time by storms.

The development of the pit is simple. Two tracks are laid side by side on the creek bed, the track on the side next to the excavation being occupied by a Browning locomotive crane and its tender, and the other track by a string of cars to be loaded with gravel, 100,000-lb. capacity coal cars being generally used in this service. The locomotive crane picks up the gravel with a clam-shell bucket and loads the cars, the crane moving back and forth along its track as the cars are loaded. The operating force consists simply of the crane engineer and his helper. The loaded cars are pulled out and the empties set in by the crew of a pusher engine stationed at Louisiana to assist trains up the Bowling Green hill. The loads are picked up and the empties are set out on side tracks at Louisiana by the local freight crews. Whenever the operations in the gravel pit necessitate the throwing of track or their extension further up the creek, a track gang of about 20 men is employed to do this work, but the men are used in the pit only when there is something for them to do, being employed as an extra gang on the main line at other times.



LOADING GRAVEL NEAR LOUISIANA, MO.

The bed of the gravel in the pit varies from 1½ to 8 ft. in thickness, and is ordinarily in condition for immediate removal, although occasionally stripping of a foot or more must be done to remove clay or silt. Because of the irregularity of the deposit the output varies from 7 to 13 cars per day, depending upon how the material runs. The load per car is 32 cu. yd. when the 100,000-lb. capacity cars are used.

The floods which supply the gravel, as previously explained, have occasionally caused considerable damage to the track layout, putting the pit out of service for several days and requiring considerable additional work by the track force. This gravel pit has been in operation under the present arrangement during this season and last. In six months last year 58,240 cu. yd. of ballast were removed. Most of the material has been used in the immediate vicinity of the pit, or between Mexico, Mo., and Clark, where it has been found to be particularly suitable for the soft sub-grade conditions encountered.

ITALIAN RAILWAYS.—The Italian army has constructed over 500 miles of railway track in the vicinity of the Austrian front since the war begun.

COMPARATIVE WATER SERVICE COSTS

BY P. M. LA BACH

Assistant Engineer, Rock Island Lines, Chicago, Ill.

VARIOUS units have been proposed from time to time as a means of comparing the relative costs of the water service of different railroads. The unit most frequently utilized has been the freight ton mile, which is a convenient figure, as it is found in the published statistics of the Interstate Commerce Commission. However, it ignores the question of passenger tonnage. The ratio of the latter to the former varies widely and in addition the amount of water needed to haul a passenger ton one mile exceeds that for a freight ton anywhere from 50 to 150 per cent. It is evident that any figures which have for a common divisor only a part of the work done must necessarily be in error.

The cost of operating a pumping plant, exclusive of fixed charges, involves a constant and two variables. The constant is the pumper's wages and the variables, the cost of fuel and the cost of repairs. To express it mathematically:

Let K = pumper's wages.
Let G = cost of fuel per 1,000 gal. pumped.
Let R = cost of repairs per 1,000 gal. pumped.
Let N = number of 1,000 gal.
Then the total cost per month equals $K + (G + R) N$.

Assigning units which are frequently found in practice, we have:

K = $50 per month.
G + R = $0.01.
N = 500.
$50 + 5 = $55.
Cost of pumping 1,000 gal. = $0.11.

K = $50 per month.
G + R = $0.01.
N = 1,000.
Cost of pumping 1,000 gal. = $0.06.

K = $50 per month.
G + R = $0.01.
N = 3,000.
Cost of pumping 1,000 gal. = $0.027.

Where larger amounts are pumped it is frequently found that another pumper is employed. This fact has a direct bearing on statistical studies of this nature. It is important to know how much water the stations furnish as units. The quantity of water used is in direct ratio to the amount of work done by the locomotives taking water at that particular station. Also water stations

are spaced as far apart as the tender tanks will permit and are usually constant in number for an engine district. If under these conditions the traffic is doubled the amount of water needed will be doubled, but the cost does not vary in the same ratio. In comparison, therefore, some allowance must be made for density of traffic. This may appear to be hypothetical, but there are many divisions of light traffic on which the pumper's wages exceed the cost of fuel, while on others with more trains the reverse is true. Another factor entering into the question is the question of grades. A railroad having light grades will perhaps haul twice as many tons per unit of water consumed as another with heavy grades.

In looking for another unit attention has been called to the fact that a locomotive develops about the same average horse power mile after mile. For instance, a consolidation engine of 1,200 hp. will be used to its limit, except on descending grades, no matter what load the ruling grade permits. Assuming that the rated horse power of locomotives will average about the same on the various railroads, the locomotive mileage could be used as a unit except for the fact that passenger locomotives use about half as much water per mile as freight locomotives. To overcome this difficulty the use of what may be called constructive engine mileage is suggested; that is, one made up of the total freight engine miles plus one-half of the passenger engine miles.

For the purpose of comparing units, the table given herewith has been prepared to show the cost of water on 21 railroads with reference to three units, namely, "mile of road," "1,000 ton miles," and "constructive engine miles." The cost in terms of miles of road gives high values for the line with heavy traffic. The cost per ton mile has the objections enumerated heretofore, while the constructive engine mileage gives relatively higher values for the road with the heavier average train loading. None is, therefore, entirely satisfactory.

Also any calculations for cost of water on a railroad, no matter what the unit, which include all water expenses are manifestly unfair to those roads which are treating a considerable portion of their water in water-softening plants. Railroads in a large part of the United States can afford to add considerable amounts to their water service costs by treating the water. While this will result in large economies, unfortunately they will not be reflected in water service costs. The same may be said of track pans. They save costs in fuel and overtime, but add to the cost of water service itself.

In view of this we can never expect to have any true comparison of the efficiency of water service on the various railroads until some means is developed for taking all of these items into account. It might be simpler to subtract the cost of these items from the total water service cost in order that a comparison might be made between figures that give only the cost of pumping the water. On many railroads the cost of water is too high, principally because the water service is without direct supervision by anyone familiar with the problems involved. In consequence a unit for the cost of water on railroads, which will permit of a fair comparision, is sorely needed and an organized effort should be made to obtain one.

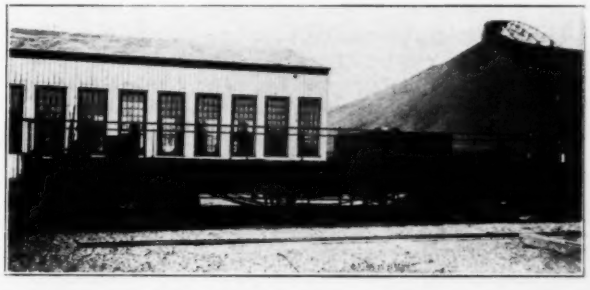
DATA ON THE COST OF WATER ON 21 RAILROADS OVER 950 MILES LONG.

	Per Mile of Road		Cost of Water		
	Freight Ton Miles	Constructive Engine Miles	Per Mile of Road	Per 1,000 Ton Miles	Per Constructive Engine Mile
Eastern Roads	5,430,286	13,586	$282.10	$0.052	$2.08
	2,788,075	9,970	128.10	.046	1.28
	2,997,966	8,422	91.80	.031	1.09
	4,255,513	12,975	142.70	.033	1.11
	3,223,935	8,679	96.60	.030	1.11
	3,011,617	5,022	67.70	.022	1.34
Southern Roads	1,116,491	4,955	43.60	0.039	0.88
	651,835	3,702	37.00	.057	1.00
	1,633,461	5,424	55.30	.034	1.02
	677,129	4,519	48.40	.071	1.07
	834,338	3,229	41.20	0.049	1.28
Middle Western Roads	942,339	3,000	33.20	.035	1.11
	639,184	3,165	43.70	.068	1.38
	1,417,388	5,038	95.10	.067	1.88
	911,648	3,149	41.80	.046	1.32
	609,465	2,642	50.30	.082	1.90
Western Roads	706,150	3,090	70.90	0.100	2.27
	732,032	3,871	63.00	.086	1.63
	788,895	2,516	81.40	.103	3.23
	1,051,899	3,836	72.60	.069	1.89
	531,952	2,989	46.60	.087	1.56

A Machine To Oil Track Fastenings

DURING the past 10 years railroad maintenance engineers have been confronted with the problem of overcoming the corrosive action of salt brine drippings from refrigerator cars on steel rails and fastenings. This problem has become more acute with the general use of high carbon steel in tie plates, screw spikes, bolts, etc., owing to the freer action of acids on steel as compared with iron. To overcome this action, A. J. Neafie, principal assistant engineer of the Delaware, Lackawanna & Western, has developed a machine for spraying oil on the rails, angle bars, bolts, tie plates and screw spikes.

The machine was constructed at the company's shops and is simple in design. A standard flat car is used to carry the necessary equipment, consisting of an air pump driven by steam from the locomotive, an air reservoir with pressure gages and reducing valves, oil and air pipes, a sand box and air sanders, two leather rail wipers, operating levers and a tool box. The flat car is handled on the head-end of the train and the operating levers are located on the forward end of the car, while the movable spraying device is attached to the car in front of the forward truck, so that the operator can see the entire mechanism. The spraying device is counterbalanced so that it can be raised and lowered with ease. A 2-in. oil line with a screening device is attached to the side of the car and is connected by a flexible hose to the center of the

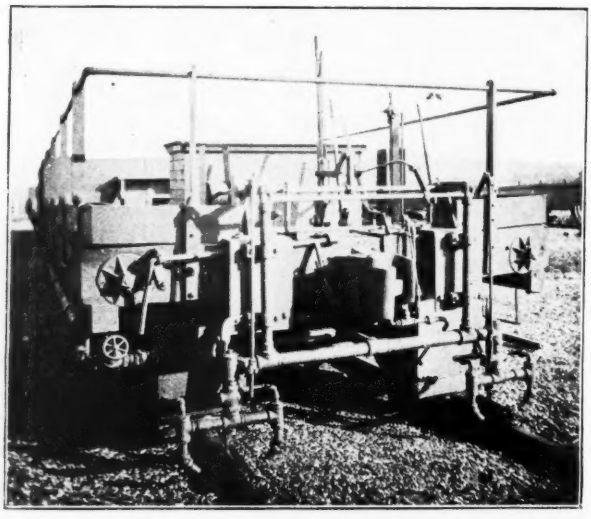


THE OIL SPRAYING CAR.

spraying device. The outlets, which discharge at the sides of the rails, are equipped with round adjustable nozzles for distributing the oil under the heads of the rails

and over the tie plates. A ½-in. air line is connected to the reservoir and discharges inside of the oil lines about 5 in. from the ends of the nozzles.

The oil car is tapped by a 2-in. oil line at the outlets, and by a ½-in. air line at the dome with flexible hose between the cars. The 2-in. oil line is attached by clamps



THE SPRAYING NOZZLES.

to the running board of the car. The steam coils are connected either to the main steam line from the engine or to the exhaust of the air pump. All lines have valves at each connection so that oil can be taken from, or heat applied to, any desired number of cars in the train.

After making several tests with different kinds of oil, it was found that a comparatively heavy oil was best adapted for spraying purposes. Experiments demonstrated that Road Oil No. 45, furnished by the Texas Oil Company, had the desired adhesive quality. This oil was used in oiling and spraying some 800 miles of track in October, 1915. The oil was heated to 150 deg. F. and an air pressure of 30 to 40 lb. per sq. in. was applied through the domes of the cars from which oil was being used. A like pressure was maintained on the ½-in. line to the nozzles to break up the oil and spray it over the proper area. The best results were obtained when the train was running between 20 and 25 miles per hour and using 100 gal. of oil per mile of track. At this rate an average of 80 miles per day can be sprayed, allowing for delays caused by regular passenger and freight traffic.

The cost of spraying based on using 100 gal. per mile and spraying 80 miles per day, is as follows:

8,000 gal. of oil at 3½ cents per gal.	$280
Engine and crew	30
Operator	5
Material and supplies	5
Total cost per day	$320
Total cost per mile	4

The economy of spraying the rail and rail fastenings has shown itself in a number of instances, as in stopping the rust scale on the web of rails and on the angle bars and bolts. The bolts are preserved by having oil on the thread line and can be taken off or tightened without destroying them. The corrosion of the tie plates, screw spikes and metal fixtures has been almost eliminated by one application of oil and there is no doubt that the oil which is sprayed on the ties preserves them at their vital points.

System in Keeping Track Bolts Tight

BY E. D. SWIFT,
Assistant Engineer, Belt Railway of Chicago

THAT splice bolts should be kept tight to perform their functions properly is a generally recognized fundamental of good track. Nevertheless, there is a lack of uniformity in the efforts to attain this desirable condition and an attitude of tolerance toward indifferent performance. One is led to believe that, owing to an almost universal prevalence of these difficulties over a long period of time, the thought on the subject is largely superficial, and that the really far-reaching ill-effects of loose bolts on the entire track structure and even on rolling equipment is not fully appreciated.

Discussion of this subject with men of long experience in responsible charge of track work discloses a general feeling that looseness in a considerable percentage of bolts is inherent in a way to normal conditions—an undesirable condition, but one impracticable of avoidance. In other instances, where the importance of the situation is more fully appreciated, a heavy renewal of bolts is considered as an essential to proper maintenance. There can be no doubt that the economies resulting from tight bolts fully justify frequent replacements if this produces the best results, or if the condition sought is impracticable of attainment by a less costly method. In a study of the situation in his work extending over a number of years, the writer has found that the frequent renewal of bolts is not only unnecessary but undesirable, in that it precludes more favorable results in the use of labor and material and more continuously effective service obtainable by other methods.

It has been found that the bolts replaced in ordinary maintenance are largely confined to those which have been loose for a sufficient time to permit the threads beyond the nut becoming damaged by corrosion or in vibration against other parts of the splice. Some of these fail in wrenching, while others are cut out. In either case, the failure is in the refusal of the nut to turn on the bolt on account of defective threads. So it is readily seen that neglect to re-tighten in time not only causes increased expense for labor and material, but of greater consequence, loose bolts being ineffective, it induces a condition of extraordinary and rapidly growing deterioration in all parts of the track in the vicinity of the joint.

Experience seems to prove that the method responsible for large renewals is that in which the work is executed in a considerable degree of thoroughness at the different times when it is performed, but that such times are limited to certain intervals. These may be established by a set rule, but are more often determined by someone on the ground from the apparent needs of the situation when bolt tightening is treated as a special order of the day and indulged in by all or a considerable part of the section crew. With other matters pressing for attention, there is naturally a tendency to stretch the

intervals, with the result that they are often so far apart that looseness is developed in a considerable percentage of the bolts before attention is attracted. Cutting out or breaking those that cannot be tightened is then in order.

The method the writer has found most satisfactory is daily inspection with re-tightening at the first indication of looseness. Thus the deterioration that is the result of looseness is arrested before actual harm is done. The work is delegated to the track-walkers, and its importance is impressed upon them. There is a greater incentive for these men to perform their work thoroughly than with gang work. The responsibility is undivided and they soon learn that procrastination results in additional work. In other words, they learn to appreciate the need for and also apply the "stitch in time."

To some it may appear that bolt tightening on a large section is a heavy assignment for a track-walker in addition to his other duties. As a matter of fact, bolts attended to in this manner require but little work on any one day.

Another cause for bolt trouble is that the actual work of tightening is at times performed in a superficial manner. Merely to screw up the nuts until all apparent looseness is taken up is insufficient. It is very important that the different parts of the splice are in proper adjustment and firmly placed. This may be accomplished as follows: After an initial tightening—which should be sufficient only to take up all slackness quite firmly—the splice-bar should be struck several sharp blows with a spike hammer along the base. The object of this is to insure that the splice-bars are not "cocked" in their position on the rail, to take out any "lagging" due to friction between splice and rail or by reason of the track spikes holding the bar and to destroy or drive out any grit or scale obstruction to a good metal-to-metal contact beween the splice-bars and the rail. After this is done, it is of the highest importance that the nuts be run home very firmly. On the latter feature the writer finds his experience somewhat at variance with a prevailing idea to the effect that bolts are often stressed beyond the elastic limit in wrenching and that this condition is a contributing influence in much bolt trouble.

It is appreciated that many bolts are broken in wrenching, but that these are almost invariably loose bolts on which the nut is bound, may be determined by an examination of the fractures, which will show twist. Obviously a bolt could not be twisted in wrenching if the nut was free to turn in the threads; and, conversely, the nut would have to turn to stretch the bolt.

It is the writer's practice to require bolts (smaller than ⅞ in. not considered) to be tightened practically to refusal, using wrenches about 40 in. in length. The ⅞-in. carbon steel bolts so treated are probably stressed more than is ordinarily regarded as good practice. The results obtained, however, through a term of several years have been uniformly satisfactory, as evidenced by a general elimination of battered rail ends. However, to bring out more detailed information of the effect of these methods on the bolts themselves, a test has been undertaken, which has now progressed sufficiently to be of some value.

In October, 1914, 80 4-hole angle bar joints in new 80-lb. A. S. C. E. rail, on track carrying a heavy freight service handled by locomotives of 50,000-lb. axle loading, were equipped with marked bolts ⅞ in. x 4¼ in., half carbon steel and half heat-treated steel. An inspection made in April, 1916, after a service of 18 months, shows but two replacements and these were in the carbon steel. The balance were all in good and effective condition.

A PORTABLE FRAMING MACHINE

THE accompanying illustration shows an ingenious application of a motor car to auxiliary operations, such as the framing of timbers. The scheme may be applied, however, by mounting a small gas engine on a car without the necessity of power operation of the car itself.

The device consists essentially of an arm made of two flat bars about four feet long attached to the frame of the engine, with a cast iron block at the outer end of the arm, bored to carry a short piece of shafting, parallel to the engine shaft, from which power is transmitted by means of a belt and pulleys. On this shaft at the end of the arm may be mounted such tools as a circle saw or a grinding stone, but in particular a cutter for dapping timbers. The arm is pivoted at its attachment to the engine, so that it may be raised or lowered by means of a vertical screw shaft, equipped with a hand wheel at

ARRANGEMENT FOR FRAMING TIES.

the top and passing through a threaded block secured between the two bars forming the arm. This shaft bears on a plate attached to the body of the car and serves to move the arm up or down when the hand wheel is turned.

Longitudinal movement of the cutting tool is obtained by moving the car backward or forward bodily on its wheels. This movement is controlled as shown in the accompanying photograph by a lever, secured to one of the wheels of the car, which can be attached or detached quickly as desired. By means of this lever very small movements of the cutter are easily obtained.

A machine of this kind has been in use on the Pere Marquette for a year with satisfactory results on about 2,000 ties and a considerable amount of heavy timber. Ties can be framed at the rate of one per minute, the speed being governed by the rate at which they can be placed on the carriage rather than by the speed of the tool. It has also been used for sawing planks and timbers and for grinding tools.

The method of procedure in using this machine for dapping or framing timbers as developed by experience is as follows: The car is put off on rails, at right angles to the main track or siding, and the timber to be framed is passed to the machine on a push car standing on the main track or siding, or if desirable to keep these tracks clear, on two rails laid for the purpose. The cutting tool for drapping makes a cut three inches wide for each

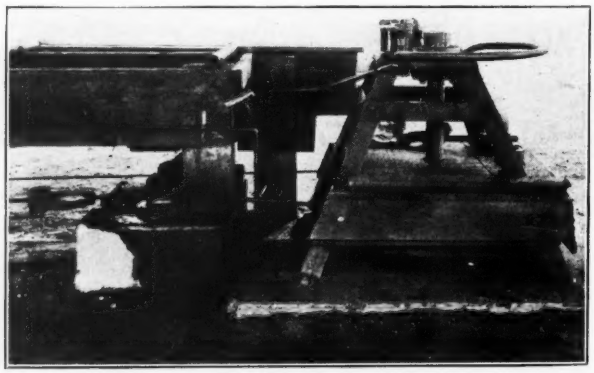
pass. As soon as one cut is made the car is moved ahead three inches to start a second cut. This operation is repeated until the desired width has been obtained.

Aside from the speed with which the work can be carried on and the accuracy of the operations when repeated on a large number of pieces, the machine has the advantage that it eliminates the need of skilled adzemen.

This device is being placed on the market by J. E. Toohey, Grand Rapids, Mich. It is equipped with a six horsepower engine and may be obtained, if desired, on a standard-gage, self-propelling motor car or on a two-foot gage car built for framing only.

A Power-Operated Bar Bender

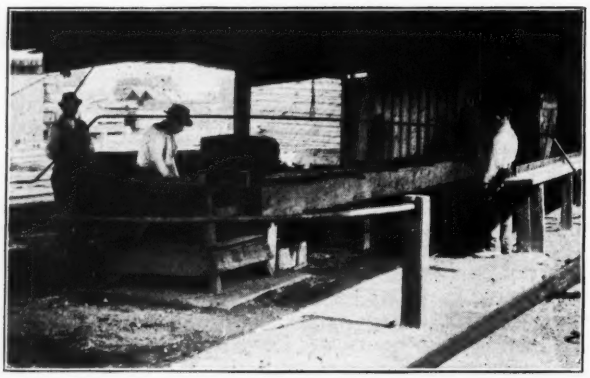
A POWER-OPERATED bar-bending machine is being used by the track-elevation forces of the Chicago, Milwaukee & St. Paul at Chicago in a material yard where, aside from the storage of all surplus construction materials, it is the practice to carry on all preparatory operations on the materials and deliver them to the site of the construction work in the exact quanti-



THE BAR-BENDING MACHINE.

ties required, thereby decreasing the congestion incident to a restricted right-of-way. In the case of the bars used in the reinforced concrete work, this consists in delivering them cut to length and bent according to the details and bills on the plans.

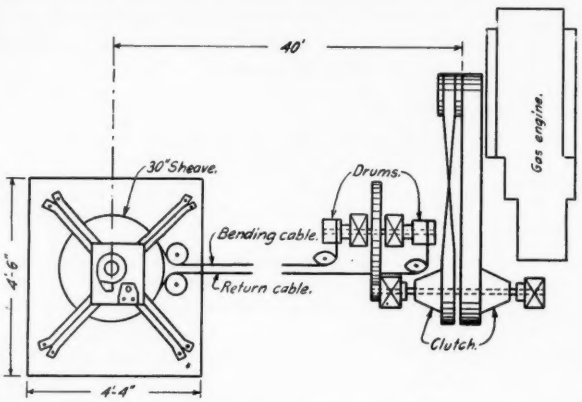
As shown in one of the accompanying photographs, the machine for bending the bars consists of a pyramidal-shaped frame made of structural steel angles supported



BENDING THE BARS.

on a concrete foundation. This frame supports a 3-in. vertical shaft, fitted at the top with a cast-steel block arranged in such a manner that a rod placed between the shaft and this block is securely held when the shaft is given a rotary motion, thereby causing the rod to be bent around the shaft. At the bottom of the shaft, just above the ground surface, a 30-in. sheave is provided. Two wire cables which have their ends attached to this sheave at a point on its circumference pass around the groove on opposite sides and lead to two drums on a small hoisting engine, as shown on the accompanying drawing. Thus the sheave, with its vertical shaft, may be rotated about 270 deg. in either direction by pulling one or the other of the two cables.

The hoist consists of two drums, which are mounted on a shaft, connected by two clutches to two pullleys belted to a 6-hp. gas engine. Each clutch is operated by means of a long rod connected to a lever located conveniently at the bender. The arrangement of the clutches and transmission is such that one drum unwinds its cable while the other one is winding up, and vice versa. Thus when one clutch is thrown in, the bar bender is turned in one direction, while the other clutch causes it to run in the other direction. The cable used to pull the shaft in the direction for bending the bars is ¾ in. in diameter, while the reverse movement is made with a



SKETCH OF THE LAYOUT.

½-in. cable. To preclude any possibility of an overrun of the cables, blocks are secured to each of them in positions where they come in contact with arms attached to the lever rods just before the limit of travel of the cable is reached, with the result that the lever is automatically pushed back into the inoperative position before the cable can run too far. In other words, the limit block on the bending cable will stop the machine just as the 180-deg. bend is completed, while the block on the reverse cable will automatically stop the reverse movement in the correct initial position ready to make another bend. For intermediate bends, of say, 45 deg., which are the most common, a second block is placed on the bend cable to stop the machine when a 45-deg. turn is completed, special provision being provided to make this block inoperative in case a 180-deg. angle is desired.

The bending machine is located under an open shed at one end of a long table equipped with rollers to facilitate the handling of the bars. The operating cables and

the clutch rods are carried under this table so that they do not interfere with the movements of the workmen. One of the accompanying photographs shows a pipe railing placed in front of the machine at a radius of about 8 ft., which serves as a support for the outer end of a bar when bends are required at a considerable distance from the end. For bars having bends near each end only, it is more convenient to turn the bar end for end after the bends on one end have been completed. This operation is facilitated by means of an overhead trolley suspended from the ceiling.

The bending of bars with the power is much faster than when the bars are bent by hand. The speed at which the work can be done or the tonnage handled per day depends upon the number of bends to be made. A one-inch bar 20 ft. long, having 8 bends, can be finished at the rate of one every three or four minutes, and it is possible to turn out three or four tons in a day of 10 hours. Before the power machine was installed six men were employed at this work. Now three men can bend about 3 times as many bars per day as were formerly bent by six.

The operation of this yard requires the employment of about 35 men, of whom 3 are employed on the bar bender and 2 on a bar shears, located at the opposite end of the shed from the bar bender. This is a Slater, Marsden & Whittemore shears, on which from 3 to 8 bars may be cut at one stroke, depending upon the size of the bar. The arrangement of the plant is such that they pass progressively from the stock piles by the shears and finally to the bender. The men not employed cutting or bending are required for loading and unloading the bars, lumber, hardware and other material stored in the yard.

The bar-bending machine was developed by the track-elevation forces of the Chicago, Milwaukee & St. Paul, who are under the general direction of C. F. Loweth, chief engineer, and the immedate direction of C. H. Buford, assistant engineer.

RENEWING TIES BY CONTRACT

PROMPTED by the scarcity of labor and the large amount of work to be done this season, the Chicago, Burlington & Quincy is experimenting with the renewal of ties by contract on the Aurora division. Early in the spring a contract was let, covering two gangs of not to exceed 20 men each. The contractor hires the men and keeps the gang full, being paid a unit price per tie renewed. The work is supervised, inspected and accepted by the regular foremen of the respective sections. The railroad furnishes the tools and the cars in which the men live. The men board themselves in the manner common to foreign laborers.

This gang is moved from section to section, being sent to those points where a sufficient number of men cannot be secured for the regular gangs and where no general surfacing is contemplated, the tie renewals being made in conjunction with the surfacing when the track is given a general raise. Preceding the gang, the section foreman in charge of the track on which the work is being done marks on the web of the rail over the center of the tie, each tie which is to be removed. The contract gang then starts at one end of the section and renews all the ties which are to come out on the entire section, after which it is transferred to another point. In this way this gang retied 11 sections between May 18 and July 4.

The contract provides that the road distribute the new ties and that the men renewing them restore the track to its original condition, including the placing of tie plates, dressing the ballast shoulder, etc., and pile the old ties on the right-of-way ready for loading or burning. In carrying on the work the foreman divides the gang of eight men into pairs and assigns to each pair a rail, marking the men's initials on one end. This serves to identify the men with the number of ties renewed in the panel as a basis for payment and also locates definitely any poor work. A separate record is kept of the ties renewed by each two men and they are paid individually on a piece-work basis.

The immediate effect of this plan has been to increase the amount of work done per man, about 50 per cent more ties being renewed with this gang of eight men than with the average section gang of the same size on adjacent sections. The men also work longer hours, starting about 5:30 a. m. and working about 11 hours per day. They appear to be pleased with the arrangement, as they are earning about $2.35 per day as compared with $1.65 on the section work. From the standpoint of the railway the work is being expedited, although increased supervision is necessary. Because of the limited extent to which this plan is being tried it is still regarded as in the experimental stage.

OBSERVATIONS ON RAIL JOINT WEAR

By G. A. DE HASETH,
Chief Engineer, Puget Sound Electric Ry., Tacoma, Wash.

THE accompanying photographs show two joints which had been in use about seven years under a service approximating 600,000 wheels. They were imbedded in a plastic soil, the cohesive nature of which accentuated an interesting condition which at its incipiency would otherwise hardly be noticeable. In the first illustration the undisturbed condition of the soil at the bearing line of the rails and the end portions of the angles shows a substantial intregality of the parts at these points. There is, however, a well-defined line of cleavage between the rail ends and the middle portion of the angle bars which indicates clearly the existence of a movement between the tip ends of the rails and the angle bars. The condition of the soil around the nuts proves them to be tight upon their bolts and that no movement between the bolts and the angle bars has taken place. It is therefore apparent that this relative movement of rail ends is not the result of any diminution of bolt pressure either through the stretching of the bolts or the loosening of the nuts.

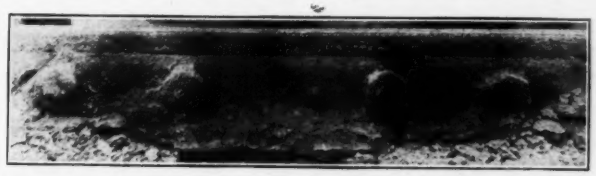


FIG. 1. CLOSE CONTACT BETWEEN RAIL AND ANGLE BAR.

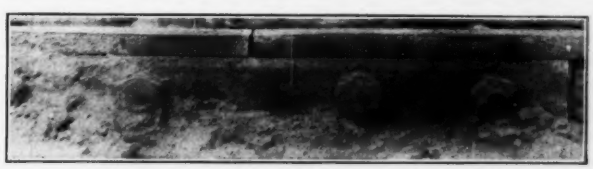


FIG. 2. SHOWING LOOSENING BETWEEN ANGLE BAR AND RAIL

Relative motion in a rail joint causes abrasion that

means loss of metal which, in the present instance, although small, is important, for the function of the angle bar is to produce an efficient junction of the rails. From the above it is obvious that, abrasion having set in, the tightening of the bolts cannot restore a rail joint of this type to its original effectiveness. In other words, such a structure is inherently deficient since it cannot prevent the relative movement of rail ends except under initial conditions.

In examining Fig. 2 a complete loosening of the grip between the angle bars and the right-hand rail ends is noted. This joint is identical with No. 1 as to construction, installation and traffic conditions. The more pronounced deterioration apparent in this case would point to some contributory factor not present in the joint shown in Fig. 1. It is known that in rolling, rails cannot be produced with such accuracy of dimensions as to insure a uniformly equal grip of the angle bars against both of the rails, the rail which is slightly smaller limiting the final seating of the angles. In consequence one rail head will engage the angle bars with less pressure than the other and abrasion will set in at such points at a comparatively early date.

Apparently there are two different and independent forces which tend to produce abrasion between rail ends and angle bars—wave motion and lateral thrust. The writer's observation is that the latter is by far the more important contributory factor. The bending strains introduced into a rail joint by the passage of a wheel over it, commonly described as a load wave, unquestionably tend to disturb the intimate contact between the rails and the angle bars at identically the same points of bearing that looseness appears in the illustration. Observation shows that abrasion of the same kind develops also, although not so rapidly, in joints that are not subject to a load wave movement of any appreciable magnitude, such as when located in track laid upon concrete and firmly imbedded in pavement. Hence the word lateral thrust is used to designate that force caused by the surging of a truck or the wedging action of a wheel flange fillet, which, with each passing wheel, exerts a side thrust on each rail end independently, and in rapid succession. Abrasion, therefore, sets in as a result of this lateral relative movement of rail ends and angles, very slightly at first, but eventually developing to such an extent or into such loss of metal as to permit noticeable vertical relative movement between the ends of the rails and the joints. As a remedy for this wear it is the opinion of the writer that a structure affording that firm union of rail and angle bars must be attained which will permanently prevent the slightest degree of relative movement of the extreme rail ends.

*WOODS USED BY THE RAILROADS

BY HOWARD F. WEISS

Director, Forest Products Laboratory, Madison, Wis.

THERE has existed for some time a rather common belief that our timber supply has become so scarce that it is now almost impossible to secure timber of good quality. This impression is quite misleading. The United States Department of Commerce estimates the amount of standing timber in the United States at approximately 2,900,000,000,000 ft. B. M. The present total annual consumption of timber in this country approximates 52,000,000,000 ft. B. M., which would indicate that our present stands of virgin timber will last approximately 55 years if the rate of exploitation continues as at present. When we add to this the amount of timber being produced annually, due to new growth, it, of course, very materially lengthens the theoretical period of exhaustion. A consumer can secure just as good timber now as formerly, and, in view of the fact that we now have grading rules based upon accurate scientific data, a customer can secure structural timber which will run even better than timber secured in years gone by when no such grading rules existed. Of course, the price of timber has advanced, just as has the price of many other products, and with the steady cutting of our virgin supply, it will undoubtedly continue to advance.

The improved conditions under which timber is now being used in the United States are making it possible to secure from it a much greater service than was secured in the past. This is excellently illustrated in the wooden cross-tie. Only a few years ago the number of ties impregnated with wood preservatives in this country was comparatively small, but within the last decade the percentage has very rapidly increased, and is continuing to do so. Thus by means of artificially prolonging the life of the natural wood, we are able not only to secure a much greater service from the woods originally used for ties, but it has been found possible to use for the manufacture of cross-ties many woods which were heretofore of little or no value. It is perhaps not far from the truth to say that the average life of untreated cross-ties in the United States is 7 years, and that our total annual consumption of ties for renewal purposes alone is around 100,000,000. From the results which have been secured in prolonging the life of wooden ties from decay, there is every reason to expect that with proper treatment an average service of about 17 years can be secured. Should this prove to be true, it will more than cut in half our present annual consumption of cross-ties for replacement purposes.

About 9 per cent of our total annual consumption of 52,000,000,000 feet B. M. of timber goes into the manufacture of ties, and about 2½ per cent is used in car construction. In addition to these two items, a very large amount of timber is used annually by the railroads in the construction of bridges, stations, and other structures. For this reason I believe it would be good policy for them to insure for themselves a plentiful supply of suitable timbers tributary to their property.

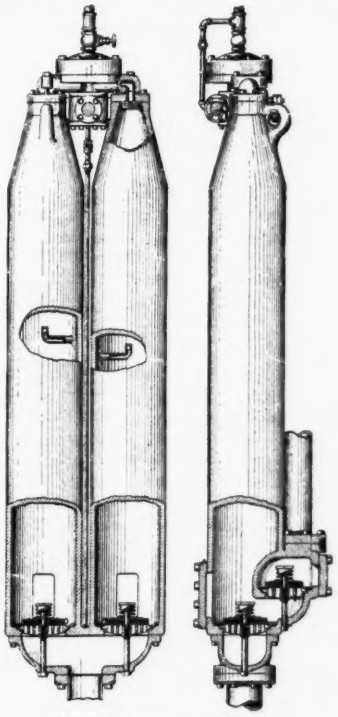
Much improvement can undoubtedly be made in present methods of inspecting timbers for railroad consumption. In fact, present methods result in much needless confusion and waste. In an attempt to improve this condition, our laboratory has just prepared a bulletin called "The Tie Guide Book," which explains in simple language and with suitable pictures how the different kinds of timber cut for ties can be identified.

A method for classifying structural timbers according to their density by mechanical tests is one of the most interesting and valuable recent results of our investigations. It is found the strength of the wood bears a direct relation to its dry weight or density; that is to say, the denser the wood the greater the strength. For example, a piece of longleaf pine, which has a specific gravity of about .40, has a modulus of rupture of about 4,600 lb. per sq. in., whereas identically the same kind of wood, but with a specific gravity of .60, has a modulus of rupture of about 10,000 lb. per sq. in. From these mechanical tests and observations certain definite mathematical equations for determining the strength of structural yellow pine timbers have been formulated. Progress has so far advanced that practical grading rules have been developed, and these have recently been adopted by the American Society for Testing Materials, the Southern Pine Association, and the American Railway Engineering Association.

*Abstracted from a paper read before the St. Louis Railway Club, May 12, 1916.

AN IMPROVED EMERSON PUMP

AN improvement has been made on the Emerson standard steam pump by the substitution of a new form of steam valve, which adds greatly to the economy and adaptability of this type of pump. The Emerson pump operates by the utilization of the vacuum produced by condensing a quantity of steam with a jet of cold water. As seen in the accompanying drawing, the pump consists of two vertical chambers connected at the bottom where they are equipped with suction valves opening upward. Discharge ports are also located in the bottom of each cyclinder, equipped with valves leading into the discharge pipe. Each chamber communicates at the top with a steam valve operated by a small 3-cylinder rotary engine, which admits steam alternately and positively, first into one chamber and then the other. The condenser



THE EMERSON PUMP

nozzles screwed into the wall of each chamber and connected with the bottom of the opposite ones, complete the apparatus.

The operation of the pump is simple, one chamber filling with water while the other one is discharging. As soon as one chamber is filled with water, the valve at the top automatically turns the steam into the chamber, forcing the water to discharge through the discharge ports at the bottom. A cushion of air over the surface of the water prevents contact between the steam and the water, and thereby precludes condensation of steam, while the chamber is emptying. Meanwhile the opposing chamber is filling with water, causing a jet of water to spray out of the condenser nozzle in the empty chamber. This condenses the steam, and the steam port at the top having been closed meanwhile, a vacuum results, and the chamber is again quickly refilled through the suction valve at the bottom. The cycle is then repeated.

Until recently the steam valve at the top was of the flat rotary slide valve type. This has now been superceded by an occilating type of valve, which has a number of advantages over the old form. The valve is balanced against steam pressure and practically eliminates friction so that no lubrication is required. It is said that the 3-cylinder engine will operate the new valve with a steam pressure of only ½ lb. per sq. in. Another advantage is the elimination of seven wearing parts required in the old valves.

Because the need of lubrication is avoided, the pumps do not require the lubricators formerly furnished, and may now be used for such service as drinking water, dye vats, etc., where the slight contamination of the water by the oil would have been objectionable.

These pumps are manufactured by the Emerson Pump and Valve Company, Alexandria, Va., and have been used extensively on railroad construction work, both by contractors and by the railroads themselves.

DETERMINING THE PURITY OF CREOSOTE

T. H. DAVIS has recently described a simple absorption spot test for the determination of the presence in creosote oil of tar, free carbon or dirt as follows: "Allow six drops of a sample of creosote oil to fall upon the surface of clean, white blotting paper. If carbon, tar or dirt is present it is observed very readily, as it segregates quickly at the center. The paper should be laid away in a flat position for a few hours in a place free from dust. If then examined, foreign matter will be observed in a distinct zone at the center of the spot; the outer zone indicates the character of the oil."

Homer Cloukey of the Forest Products Laboratory, Madison, Wis., has run a series of tests to verify the Davis "absorption spot test" and to obtain some idea of the sensitiveness of the test for tar, carbon or dirt. In order to make it fairly quantitative, a series of spots were made from carbon-free creosote oil to which free carbon in the form of lampblack had been added in definite graduated amounts. The series comprised six mixtures of creosote and lampblack with percentages of lampblack of 0.0, 0.005, 0.01, 0.05, 0.10 and 0.50.

The results showed an increasing gradation in the density of the free-carbon ring at the center and indicated that 0.005 per cent is easily shown by this test. In heavier percentages than 0.5 per cent the amount in an unknown sample would be difficult to estimate by comparison. The admixture of tar to creosote can be determined roughly from the size of the inner zone and the general character of the spot. The heavy tar does not diffuse with the speed of the lighter creosote oil.

The presence of dirt, tar or free carbon in creosote in very minute quantities is indicated by this test. If the creosote spot shows a dense black center it will probably be necessary to run a free carbon specification. When pure, high-gravity distillate oil is specified and the spot test is used in the preliminary examination of the oil the slightest adulteration with coal tar can be detected instantly.

It will be noted from the determinations made by Mr. Cloukey that percentages of free carbon greater than 0.05 per cent can be estimated only with difficulty. It is apparent that in order to secure a pure creosote of the quality of No. 1 maintenance of way oil or a pure, high-grade distillate oil the spot test is practically essential in the preliminary examination.

St. Paul, Minn., adopted the spot test some time ago and made it a part of the city's specifications for a pure distillate oil for the treatment of its wood paving blocks. The spot test has also been adopted by the Diesel Engine Users' Association of England for the examination of the fuel oils used in this type of engine.

GENERAL NEWS DEPARTMENT

THE PRESIDENT OF CUBA has signed a bill providing for a commission to study the question of government ownership of railroads in Cuba.

THE MISSOURI PACIFIC has increased the wages of its section men an average of six per cent and of section foremen $5 per month, effective August 1.

THE EL PASO & SOUTHWESTERN is reported to have given a voluntary increase of 7½ per cent in rate of wages of shopmen, section foremen, clerks, telegraphers and train despatchers.

THE CHICAGO, BURLINGTON & QUINCY is equipping its new lounging cars for its Chicago-Denver, Chicago-Omaha and Chicago-St. Paul trains with soda fountains, similar to those used in drug stores, from which passengers may be served at any time of the day or night.

THE BUFFALO, ROCHESTER & PITTSBURGH has placed its name in conspicuous lettering on all overhead bridges where state highways cross the railroad for the purpose of giving people in automobiles a convenient landmark and to make the name of the road familiar to everybody.

AN ARMORED CAR has recently been completed by the Standard Steel Car Company for the United States Army. This is the first car of this kind ever constructed for this army. It is to be equipped with a three-inch rapid fire field gun and has 20 port holes for machine guns or small arms.

THE QUEBEC BRIDGE across the St. Lawrence river is rapidly approaching completion. The south cantilever arm was completed on July 25, the north arm having been completed late last year. It is expected that the suspended span will be floated into place early in September, completing the erection of the steel.

P. H. DUDLEY, consulting engineer, New York Central Lines, has recently made a statement that no transverse fissures have been found in basic open-hearth rails rolled according to the specifications of the New York Central Lines and from reheated blooms. He advocates the reheating of all blooms as a means of eliminating this serious cause of failure.

THE PRESIDENT'S CONFERENCE COMMITTEE ON VALUATION has published a summary of the Federal valuation reports on the Texas Midland, the Atlanta, Birmingham & Atlantic, the Norfolk Southern, the San Pedro, Los Angeles & Salt Lake and the Elgin, Joliet & Eastern. These are the first properties on which the government has completed its valuations.

THE PENNSYLVANIA RAILROAD reports that in the first six months of the present year 92,380,184 passengers were carried on the company's lines without the loss of the life of a single one in a train accident. This completes two and one-half years in which no passenger has been killed in a train accident on any part of the Pennsylvania System, either east or west of Pittsburgh.

THE NATIONAL CONFERENCE COMMITTEE OF THE RAILWAYS met with the representatives of the four brotherhoods of train service employees in New York on Tuesday, August 8, to receive the returns from the strike vote and to renew negotiations leading to the settlement of the wage controversy. On the following day the roads requested the aid of the United States Board of Mediation and Conciliation in the settlement of the controversy, but this failing, President Wilson asked the representatives of the railways and the employees to confer with him on Monday, August 14. It soon became evident that President Wilson had accepted in large part the demands of the employees. In his conference with the railway officers he recommended the concession by the railways of the 8-hour *basic* day, and urged that the demands for extra pay for overtime and the contingent proposals of the railways should be postponed pending an investigation by a special commission. Failing to secure the approval of his plan from the committee representing the railways, he summoned over fifty leading railway executives to Washington on the following Sunday and presented the matter before them. These men supported the action of their committee, and in a statement presented to the President on Monday, August 28, again urged their desire for arbitration of the entire issue.

THE PUBLIC SERVICE COMMISSION for the First District of New York has issued an order to various railroads and rapid transit lines operating in New York City directing them to furnish reports of the condition of all bridges and elevated structures within 30 days after the end of each calendar year. These reports must contain statements to the effect that the bridges have been inspected by competent officers or employees of the respective companies and if found safe the reports must so state. If they are found to be not thoroughly safe, the reports must further state what steps have been taken to place them in safe condition.

THE PENNSYLVANIA RAILROAD has given orders for the adoption of the green-yellow-red scheme for night signal indications on its lines. The order includes not only fixed signals, but markers on the rear of trains, switch lamps, markers for track tanks, slow signs, resume speed signs, hand lamps at interlocking and block signal stations and lights at public crossings. Lights at highway crossings will be red instead of green as at present. It is expected that the change will require some little time for its accomplishment, as the number of glasses to be changed runs into the hundreds of thousands, and because of present industrial conditions, deliveries of material may be slow.

THE NATIONAL ASSOCIATION OF RAILROAD COMMISSIONERS, the American Railway Association and the American Automobile Association conferred at New York City through their representatives relative to joint action by the three associations concerning the promotion of safety at grade crossings. It was agreed to ask the American Railway Association to call together a committee of railroad counsel to draft bills covering the question of regulation of traffic at grade crossings, with a view to the prevention of accidents, these bills to be submitted to the Public Service Commissions of the several states and to the Automobile Association for criticism. It is then proposed to have a further conference in Washington prior to the annual convention of the National Association of Railway Commissioners.

THE SOUTHERN PACIFIC is conducting a school on wheels for the children of the men employed in an extra gang on the Los Angeles division. More than 25 children belonging to the families of the 50 men employed in this gang attend and they are being taught in a box car fitted up with benches. A teacher is employed who instructs them daily in English and Spanish and in primary work. The car is moved from place to place with the gang so that the children do not miss a day's schooling. Arrangements are now being made to replace the car with an old passenger coach which will be fitted with benches and blackboards and will be easier to heat. The results from the school have not only been satisfactory, but the class of men retained in the gang is high. It is also planned to fit up a hospital car for the women and children in the camp who may become ill.

THE SUPREME COURT of the State of Washington holds that a person inspecting the main track of a railroad engaged in intrastate and interstate commerce is engaged in interstate commerce within the act. The rules of a railroad required section men to keep a lookout for trains. An employee, who was killed while inspecting the track on a speeder, was held to be guilty of negligence in not maintaining a lookout for trains, regular or irregular, particularly as he wore a cap which covered his ears so as to affect his hearing, and his negligence was at least equal to that of the railroad in running an engine backwards without maintaining a proper lookout. The action was tried without a jury, and the trial court made no deduction for the deceased's contributory negligence. It was held that the Supreme Court might make such deduction from the award and affirm the judgment.

PERSONAL MENTION

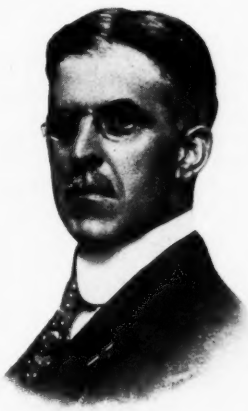
GENERAL

P. J. LANDERS, engineer maintenance of way and acting superintendent of the Indianapolis Union Railway, was appointed superintendent on August 1, succeeding A. A. Zion, who was granted a leave of absence several months ago and who has since retired on a pension.

A. W. JOHNSTON, who has been appointed assistant to the president of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, entered railway service as a draftsman in the office of the general superintendent of the Pittsburgh, Cincinnati, Chicago & St. Louis in 1875, after graduation from the Massachusetts Institute of Technology. He entered the employ of the New York, Chicago & St. Louis as division engineer in April, 1884, being made division superintendent on October 1, 1893. He was appointed general manager on February 1, 1906, which position he held until the time of his recent promotion.

ENGINEERING

E. G. LANE, district engineer maintenance of way of the Baltimore & Ohio Southwestern, has been promoted to engineer maintenance of way of the Baltimore & Ohio Lines West, and and of the Cincinnati, Hamilton & Dayton, with office at Cincinnati, Ohio. Mr. Lane was born in 1869, and after a preliminary education attended Northern Ohio University and later took a special course at Cornell University. He first entered railway service on May 1, 1888, as a levelman on the Valley Railway (Ohio), now the Cleveland division of the Baltimore & Ohio. On January 11, 1899, he entered the service of the Baltimore & Ohio, and from that time until January, 1905, he was successively assistant engineer on the Cleveland, Cumberland and Pittsburgh divisions. He was then made division engineer of the New Castle division and on January 1, 1907, was promoted to district engineer maintenance of way at Pittsburgh, Pa. He remained in that position until November 10, 1911, when he was made assistant engineer of operation in the office of the vice-president at Baltimore, Md. From March, 1914, to July, 1916, he was district engineer maintenance of way of the Baltimore & Ohio Southwestern, with office at Cincanniti, Ohio. As engineer maintenance of way of the Baltimore & Ohio Lines West and of the Cincinnati, Hamilton & Dayton he will continue to have headquarters at Cincinnati.



E. G. LANE

EDGAR J. CORRELL, division engineer of the Baltimore & Ohio Southwestern at Chillicothe, Ohio, was appointed district engineer maintenance of way of the Southwest district of the Baltimore & Ohio, Lines West, with headquarters at Cincinnati, Ohio, effective August 20. He was born at Canton, Ohio, on October 23, 1871, and received his education in the public schools of that city and in Ohio Northern University. He began railway service as a rodman with the Baltimore & Ohio Southwestern in September, 1896. In January, 1898, he was promoted to transitman and in May, 1901, to assistant division engineer, with headquarters at Chillicothe, Ohio. The following year he was made assistant engineer and transferred to Cincinnati, Ohio, and in May, 1902, again was appointed assistant division engineer, with office at Washington, Ind., remaining in this position until April, 1903. He was division engineer of the Ohio division at Chillicothe, Ohio, from April, 1903, to May, 1908, when he left the Baltimore & Ohio System to become engineer maintenance of way of the Missouri Pacific at Little Rock, Ark. He returned to the Baltimore & Ohio in August, 1911, as division engineer at Chillicothe, Ohio, which position he held until the time of his recent promotion.

FRANCIS DANIEL BATCHELLOR, district engineer maintenance of way of the Cincinnati, Hamilton & Dayton, has had his jurisdiction extended over the Northwest district of the Baltimore & Ohio Lines West, with headquarters, as heretofore, at Cincinnati, Ohio. Mr. Batchellor was born at Liverpool, Eng., on September 15, 1878, and received his education from a manual training school at Philadelphia Pa. and the International Correspondence Schools at Scranton, Pa. He began railway work in 1898, in the office of the supervisor of the Pennsylvania Railroad at Tacony, Pa. From 1900 to 1903 he was an assistant in the engineering corps of the Pittsburgh, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, and from July, 1903, to September, 1907, was employed in the same capacity on the Baltimore & Ohio Southwestern. He was assistant division engineer of the Indiana division of the Baltimore & Ohio Southwestern from September, 1907, to September, 1910, when he was promoted to assistant engineer maintenance of way. In March, 1911, he became division engineer of the Indiana division of the same railroad and retained this position until December, 1912, when he was appointed assistant to the general superintendent of the Baltimore & Ohio Southwestern and the Cincinnati, Hamilton & Dayton. In June, 1913, he was appointed assistant superintendent of the Toledo division of the Cincinnati, Hamilton & Dayton, and remained in this connection until July 1, 1913, when he was promoted to district engineer maintenance of way of the Cincinnati, Hamilton & Dayton, with office at Cincinnati.

F. D. BATCHELLOR

M. P. NORTHAM, office engineer of the Southern Railway, Washington, D. C., has been appointed supervising engineer, maintenance of way department, with headquarters at Washington.

T. R. RATCLIFF has been appointed engineer maintenance of way of the Indianapolis Union Railway, with headquarters at Indianapolis, Ind., succeeding P. J. Landers, appointed superintendent.

TRACK

N. T. BLACKWELL, roadmaster on the St. Louis division of the Chicago Rock Island & Pacific, has transferred his headquarters from Windsor, Mo., to Eldon.

J. L. CONOVER has been appointed assistant supervisor of subdivision 32 on the Philadelphia division of the Pennsylvania Railroad, succeeding E. D. Flad, transferred.

GEORGE MATHIASEN has been appointed roadmaster of the Chicago & Northwestern at Montfort, Wis., to succeed D. Manning, assigned to other service, effective August 11.

CLIFFORD JOHNSON has been appointed roadmaster of the Chicago-Aurora division of the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill., succeeding Roy C. Violett, transferred.

C. GREISHEIMER, acting supervisor and master carpenter of the Cincinnati, Hamilton & Dayton, between Dayton, Ohio, and Dean, has been appointed master carpenter in charge of the Delphos division.

JOHN TRUITNER, roadmaster on the Rocky Mountain district of the New Mexico division of the Atchison, Topeka & Santa Fe, with headquarters at Raton, N. M., has been transferred to

the Third district. J. E. Truitt, extra gang foreman, has been appointed roadmaster at Raton, N. M., succeeding Mr. Truitner, effective August 20.

M. H. BEARD has been appointed supervisor of the Cincinnati, Hamilton & Dayton in charge of the Findlay-Ft. Wayne branch of the Delphos division, with headquarters at Ottawa, Ohio, in place of Simon Baker, assigned to other duties.

CHARLES JEROME MEYERS has been appointed supervisor of the Cincinnati, Hamilton & Dayton, with jurisdiction over the lines between Dayton, Ohio, and Dean, in place of C. Greisheimer, assigned to other duties. Mr. Meyers was born on April 25, 1874, at Pittsburgh, Pa. He graduated from Wittenberg College and from the Case School of Applied Science. His railway career commenced in September, 1902, when he was employed as an extra gang foreman by the Union Pacific. He remained in this connection until March 1, 1904, when he went to the Chicago & Northwestern as general foreman of construction. In June, 1907, he took employment on the Pennsylvania Lines as steel foreman. He entered the service of the Chesapeake & Ohio in October, 1911, as yard gang foreman and in April, 1913, was made assistant steel gang foreman on the Cleveland, Cincinnati, Chicago & St. Louis. In December, 1915, he was appointed steel gang foreman on the Cincinnati, Hamilton & Dayton and retained this position until his present appointment, which became effective August 1. His headquarters are at Chillicothe, Ohio.

BRIDGE

ROBERT FARNHAM, JR., whose appointment as assistant engineer of bridges and buildings of the Pennsylvania Railroad, with headquarters at Philadelphia, Pa., was announced in the issue of last month, was born at Washington, D. C., on December 19, 1877. He was educated at private schools and at the Preparatory School of Columbia University, Washington, D. C., after which he graduated from the civil engineering course of Lehigh University in 1899. He entered the employ of the bridge department of the District of Columbia in July of that year. From July, 1902, to March, 1903, he was engaged in the design of steel buildings with J. H. Gray & Company of New York City. On this latter date he entered the service of the Pennsylvania Railroad as a transitman at Washington, D. C. In August of the same year he was appointed assistant engineer of construction and was placed in charge of the elimination of grade crossings at Washington. He was transferred to the office of the engineer of bridges and buildings at Philadelphia in March, 1910, and was appointed assistant to the engineer of bridges and buildings on August 1, 1913. He was appointed assistant engineer of bridges and buildings in July, 1916, as noted above.

ROBERT FARNHAM, JR.

H. S. BADDERS has been appointed master carpenter of the Seaboard Air Line, with headquarters at Hamlet, N. C., in place of W. J. Galloway, resigned. He was born at Baltimore, Md., on December 10, 1863, and first entered railroad service on July 28, 1914, as carpenter foreman on the Georgia division of the Seaboard Air Line.

C. W. LENTZ, supervisor of bridges and buildings of the Illinois Central at Dubuque, Iowa, has been appointed bridge inspector, with jurisdiction over the system south of the Ohio river. John Morphew, bridge foreman, has been appointed bridge inspector, with jurisdiction over the system north of the Ohio river. Hugh Callahan, bridge foreman on the Minnesota division, succeeds C. W. Lentz as supervisor of bridges and buildings at Dubuque.

CONSTRUCTION NEWS

THE ATCHISON, TOPEKA & SANTA FÉ has filed articles of incorporation for the construction of a line 70 miles southwest from Lubbock, Texas, to a point near Seminole.

This road has awarded a contract to Sharp & Fellows, Los Angeles, Cal., to erect a passenger station at Colorado Springs, Colo., at an estimated cost of $175,000.

THE ATLANTIC COAST LINE has awarded a contract to Wade, Clower & Wade, Jacksonville, Fla., to build the extension of the Haines City branch from the present southern terminus at Sebring, Fla., south via Venus, Palmdale and Hall City to Immokalee, 80 miles, with a branch to Moorehaven, 20 miles. The maximum grade will be 0.4 per cent compensated and the maximum curvature 4 deg. A drawbridge will be built over the Caloosahatchee river. The company expects to develop a traffic in citrus fruits, vegetables and lumber.

THE BALTIMORE & OHIO has awarded a contract to the Bates & Rogers Construction Company, Chicago, for grading, tunneling and masonry work on the Long Fork Railroad in northeastern Kentucky, at an estimated cost of $500,000. This line is to be built from a junction with the Chesapeake & Ohio at the forks of Beaver creek to Weeksbury, Knott county, a distance of 26 miles. The work involves 450,000 cu. yd. of excavation and embankment, the construction of five tunnels from 140 ft. to 775 ft. in length, and 10,000 cu. yd. of masonry work. The maximum curvature is 10 deg. and the maximum grade with the traffic 1.9 per cent.

This road is elevating its tracks for about a mile through Defiance, Ohio. The work involves the laying of a second track, closing the last remaining gap on the east end of the Chicago division, the construction of bridges over the Auglaize river and the W. & E. canal, the construction of subways at Jefferson, Wayne, Clinton and Summit streets and the reconstruction of subways at Washington and Francis streets. New passenger and freight facilities are also being provided. The total cost of all improvements is estimated at $530,000. The North American Railway Construction Company, Chicago, has the contract for the subway masonry, grading and paving; the Pittsburgh Construction Company has the contract for the false work in the river, and the Carmichael-Dryder Company, St. Louis, Mo., the contract for the bridge masonry.

THE CANADIAN NORTHERN has let a contract for a line from Kamloops, B. C., to Kelowa. Work on a new bridge over the Thompson river has already been commenced, as well as for the grading southwest from Vernon, B. C.

THE CHICAGO & EASTERN ILLINOIS plans to erect a passenger station at Danville, Ill., at an approximate cost of $95,000. The structure will have concrete foundations, brick walls with stone and terra cotta trimmings and a hollow tile roof. The Clarke Construction Company, Danville, Ill., has the contract for the train sheds. The structural steel will be furnished by A. Bolter's Sons, Chicago.

THE CHICAGO & NORTH WESTERN, the Chicago, Burlington & Quincy, the Minneapolis & St. Louis and the City of Peoria (Illinois) have jointly awarded a contract to the Widell Company, Mankota, Minn., for the construction at Peoria, Ill., of a reinforced concrete viaduct to carry Adams street over the tracks of the above railroads. The structure will be approximately 1,100 ft. long between abutments, and will rest on 29 piers. The cost of the work is estimated at $100,000, which will be shared by the city and the railroads.

THE CHICAGO, MILWAUKEE & ST. PAUL plans terminal improvements at South Beloit, Ill., which will cost about $65,000.

This road is also planning the construction of terminal facilities at Atkins, Iowa, to cost about $614,000. The improvements will include a 26-stall roundhouse, a 90-ft. turntable, a 154-ft. cinder pit, a coal-handling plant, a power house 50 ft. by 80 ft., a blacksmith and machine shop 50 ft. by 90 ft., a storehouse 50 ft. by 100 ft., an ice house and other buildings, as well as a modern yard for handling increased traffic. The concrete work will probably be done by company forces, and bids have been asked for in connection with the grading.

THE ERIE is making improvements on County Road, Secaucus, N. J., which include the construction of a 36-stall roundhouse to have 115-ft. stalls and a 100-ft. turntable, a machine shop, a power house, a storehouse and a complete engine terminal. The foundations of the buildings will be of concrete, while the superstructures of the roundhouse and machine shop will be of frame construction and the power house of tile. The Robert Grace Contracting Company, Pittsburgh, Pa., has the contract for the work, which is estimated to cost $650,000.

THE GRAND TRUNK has started work on new repair shops at Port Huron, Mich., which will cost approximately $700,000. There will be eight buildings in the group, which are intended to accommodate 30 passenger and 75 freight cars at one time. About 15,000 ft. of new trackage will be required.

THE ILLINOIS CENTRAL has awarded a contract to the Lynch Construction Company, Monmouth, Ill., for the raising of the tracks at five points on the St. Louis division, totaling about five miles. Work has also been started on a change of line and grade between Evers, Ill., and Effingham, five miles, for which the above company has the contract.

THE JACKSONVILLE TERMINAL COMPANY has started condemnation proceedings in the Circuit Court to acquire land necessary for the site of the proposed new passenger station and tracks in Jacksonville, Fla. This is the first legal step taken in the construction of a $2,000,000 project. Plans for the station building, which will cost about $1,000,000, are now being completed by New York architects. Engineers are already on the ground planning the preliminary work which will begin soon.

THE KANSAS CITY TERMINAL will make terminal improvements at Kansas City, Kan., at an approximate cost of $4,000,000, which include the erection of two $100,000-passenger stations, two freight stations, a double-deck, double-track bridge and a long double-track steel viaduct over the Kaw river and the laying of five miles of new track. The work involves the use of 17,000 tons of steel and 40,000 cu. yd. of masonry. A contract has been let to the American Bridge Company for the fabrication of the 17,000 tons of steel required for the bridge and viaduct.

THE LOUISIANA RAILWAY & NAVIGATION COMPANY will build a passenger station at Rampart street, New Orleans, La., which will be 36 ft. high, 50 ft. wide and 250 ft. long, of brick and concrete construction with a granite front. Work will be started about September 1. Freight facilities will also be improved. The total cost of this work is estimated to reach $350,000 to $500,000.

THE MISSOURI, KANSAS & TEXAS has awarded a contract to widen its roadbed between Osage, Okla., and Wybark, which involves approximately 168,000 cu. yd. of excavation.

THE NEW YORK CENTRAL, in connection with the Pennsylvania, has commenced the elimination of grade crossings with six of the principal streets in Erie, Pa. The work will extend over a period of about five years, and in connection therewith a modern passenger station will be constructed.

THE NEW YORK, NEW HAVEN & HARTFORD will spend about $250,000 in improvements to freight and passenger terminals at New Haven, Conn., although definite plans are not yet made.

THE NORTHERN PACIFIC has awarded a contract to Siems, Wickham & Company, St. Paul, Minn., to grade a branch line from Dixon, Mont., to Polson, a distance of 33.75 miles.

THE PENNSYLVANIA LINES WEST have awarded a contract to the C. R. Cummins Company, Chicago, to build double track from Columbus, Ohio, to Lewis Center, 15 miles, and the work is now under way.

THE PENNSYLVANIA RAILROAD has awarded a contract to W. F. Trimble & Sons Company, Pittsburgh, to construct a 14-stall roundhouse at Derry, Pa. The structure will be of brick and wood with a wood-block floor, wooden rolling doors and built-up roofing, and will cost about $75,000.

This road has also awarded a contract to Warren, Moore & Company of Philadelphia to build two freight houses at Harrisburg, Pa., at an approximate cost of $350,000. Both buildings will be of reinforced concrete, the inbound house being 44 ft. long by 50 ft. wide and four stories high, while the outbound house is 470 ft. long by 20 ft. wide and one story high.

THE SEABOARD AIR LINE has awarded a contract to the Vaughan Construction Company, Shawville, Va., for the construction of a portion of the 10 miles of line between Hamlet, N. C., and Gibson. This work is part of a plan to establish a low-grade line from Hamlet, N. C., to Savannah, Ga., via Charleston.

THE SOUTHERN PACIFIC will build a 10-story steel-frame, brick and concrete office building on Market street, between Stewart and Spear streets, San Francisco, Cal., which will be 275 ft. wide by 290 ft. long. Over 2,000 115-ft. piles will be driven to furnish a foundation for the building. The eight top floors will be used for general office purposes by the Southern Pacific, and all of the first two floors, except space on the first floor for the district freight agent, will be rented to the public. The estimated cost of the building is $1,750,000. Bliss & Fayville are the architects.

THE WASHINGTON-NEWPORT NEWS SHORT LINE has filed applications with the War Department at Washington for the approval of its plans for bridges over the Potomac, Rappahannock and York rivers. This company was chartered in Virginia last January to build a railroad from Newport News, Va., to Washington, D. C.

THE WHEELING COAL RAILROAD, a subsidiary of the Pennsylvania Railroad, has been incorporated in West Virginia and has adopted a location for a railroad from a point on the Pennsylvania-West Virginia state line, near Majorsville, to a junction with the Wheeling Terminal Railway at Wheeling, in Wheeling Creek valley. The survey has been made for that part of the line in Pennsylvania, which will extend from a point on the Pennsylvania-West Virginia state line near Majorsville east to Marianna, where a connection is proposed with the Millsboro branch of the Pennsylvania Railroad. Application has been made for a certificate of public convenience covering the construction of the line in Pennsylvania, and after that has been granted a company will be organized and a location for the route adopted.

STRUCTURAL STEEL

THE BALTIMORE & OHIO has ordered 300 tons of bridge steel from the American Bridge Company.

THE BOSTON & MAINE has divided an order for 200 tons of bridge steel between the American Bridge Company and the Fort Pitt Bridge Works.

THE CHICAGO, BURLINGTON & QUINCY has ordered 1,478 tons of bridge steel from the American Bridge Company.

THE CINCINNATI, HAMILTON & DAYTON has ordered 300 tons of bridge work from the American Bridge Company for bridges in Ohio.

THE DENVER & RIO GRANDE has ordered 288 tons of bridge steel from the American Bridge Company for bridges in Colorado and Utah.

THE DULUTH, MISSABE & NORTHERN has ordered 201 tons of steel from the American Bridge Company for a bridge over the White Face river at Kelsey, Minn., and 115 tons of steel from the same company for a bridge over the St. Louis river at Forbes, Minn.

THE LEHIGH VALLEY has ordered 400 tons of steel from the Pennsylvania Steel Company for a bridge at Rochester, N. Y.

THE NEW YORK CENTRAL has ordered 700 tons of steel from the American Bridge Company for a bridge in Youngstown, Ohio.

THE ST. LOUIS SOUTHWESTERN has ordered 267 tons of bridge steel from the American Bridge Company for 2 single-track pony truss spans.

THE SEABOARD AIR LINE has ordered 2 bridges, aggregating 800 tons of steel, from the American Bridge Company to repair flood damage.

THE SOUTHERN RAILWAY has ordered 8 bridges, with a total of 700 tons of steel, from the Virginia Bridge & Iron Company, Roanoke, Va., for flood repair work.

TRACK MATERIALS

THE CANADIAN NORTHERN has ordered 15,000 tons of rails from the United States Steel Corporation.

THE HAVANA CENTRAL has placed orders with the U. S. Steel Corporation for 10,000 tons of steel rails, which will be rolled at Chicago.

THE CANADIAN PACIFIC has placed an order for 10,000 tons of steel rails with the United States Steel Corporation.

SUPPLY TRADE NEWS

PERSONAL

C. FURNESS HATELY has been elected president of the National Surface Guard Company, Chicago, succeeding the late James T. Hall.

WALTER D. THOMAS, for many years representative in the southeastern states for the Rodger Car Company, Chicago, died July 10.

T. F. FLANAGAN, assistant sales manager of the Pyrene Manufacturing Company, New York, has been appointed general sales and advertising manager.

JAMES A. MCINTOSH, a member of the contracting firm of McIntosh Brothers, died in Milwaukee on July 28, at the age of 71 years. Among other work, Mr. McIntosh constructed a considerable part of the Pacific Coast extension of the Chicago, Milwaukee & St. Paul.

J. L. TERRY has become associated with the sales department of the Q. & C. Company, New York. Mr. Terry was formerly with the Denver & Rio Grande, was later purchasing agent of the Denver, Laramie & Northwestern, and subsequently served as superintendent and general manager.

A. C. GARRISON has been elected president of the Corrugated Bar Company, St. Louis, Mo., to succeed his father, D. E. Garrison, deceased. A. L. Johnson has been appointed vice-president and general manager, and W. H. Kennedy, vice-president and treasurer. W. M. Armstrong, vice-president and sales manager, has resigned.

THOMAS J. DRUMMOND, president of the Lake Superior Corporation, the Canadian Iron Corporation, and the Algoma Steel Corporation, Ltd., died suddenly August 6 at his summer home in Castine, Me. Mr. Drummond was born in Tawley, Ireland, September 26, 1860, and received his education in the public schools of Montreal. In 1882 he became a partner in the firm of Drummond, McCall & Co., of Montreal, manufacturers of iron and steel, and in this connection aided in the founding of the Montreal Car Wheel Company, the Canadian Iron Furnace Company, the Radnor Forges and the Drummond-McCall Pipe Foundry. He was also president of the Algoma Central Railway, and held directorships in the Canadian Car & Foundry Company, the Cockshutt Plow Company and the American Iron and Steel Institute.

GENERAL

THE SQUIRE-COGSWELL COMPANY has been incorporated in Chicago and will take over the railway supply business formerly carried on under the name of Willis C. Squire & Company.

THE BETHLEHEM STEEL BRIDGE COMPANY of Delaware has been organized to take over the business of the Pennsylvania Steel Company with headquarters at Steelton, Pa. The officers of the new company are G. H. Blakeley, president; Thomas Earle, vice-president; B. H. Jones, secretary and treasurer, and F. A. Shick, controller.

THE RAIL JOINT COMPANY, NEW YORK, has made the following announcement: "The Bonzano Rail Joint Company, as well as the Q. & C. Company, by advice of their counsel after investigation of the Thomson and Thomson rail joint patents owned by the Rail Joint Company, have recognized the utility and validity thereof, and have taken a license thereunder in order to utilize the Thomson and Thomson novel system of metal distribution, for head reinforcement, in connection with their Bonzano types of splice bars. Accordingly, notice is given by the Rail Joint Company that the aforesaid companies are authorized under the Thomson and Thomson patents in the manufacture and sale of the Bonzano type of splice bars having the Thomson and Thomson system of metal distribution for head reinforcement."

AMERICAN RAILWAY EQUIPMENT IN THE FAR EAST

Continued interest in the markets of the far east, Australia and South Africa has led the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, to undertake an investigation of the field for American railway equipment and supplies in that section of the world. Frank Rhea, of the division of valuations of the Interstate Commerce Commission, has been appointed special agent to make the investigation, and is already engaged in making arrangements for conferences with manufacturers, contractors and selling agents, which will be held during a preliminary trip to the principal manufacturing centers in this country. This preliminary trip will be made in September.

When the special agent has learned what information the manufacturers in this country want concerning railway conditions across the Pacific, he will go abroad and make a careful study on the ground of the conditions as they affect railway construction, equipment, traffic, the probable extension or reconstruction of railways, tramways, etc. While all specific opportunities for securing orders will be promptly reported, the real purpose of the investigation is to gather together the fundamental facts and conditions that will enable the American manufacturer to consider intelligently the different fields, and to determine whether it is to his advantage to enter any of them.

Manufacturers and others who wish to get in touch with Mr. Rhea before he leaves this country should address the Division and Commercial Agents, Bureau of Foreign and Domestic Commerce, Custom House, New York.

TRADE PUBLICATIONS

WOOD CONSTRUCTION AND FIRE LOSSES.—The National Lumber Manufacturers' Association, Chicago, has issued a 15-page booklet pointing out some of the errors in the commonly accepted ideas regarding the large fire losses resulting from timber construction and presenting a large amount of data regarding actual and accurate comparison. This book contains a large amount of information of value to those interested in wood construction from the standpoint of the fire hazard.

MORTAR.—The Hydrated Lime Bureau of the National Lime Manufacturers' Association has issued a 32-page booklet describing a series of tests conducted by J. S. Macgregor, professor of civil engineering, Columbia University, on the effect of adding hydrated lime to cement mortar used in brick work. This booklet contains a large amount of interesting information regarding these tests, showing that the use of hydrated line results in a greater strength at a less expense for materials.

STEAM HAMMERS.—The National Hoisting Engine Company, Harrison, N. J., has issued a 20-page catalogue describing the National steam pile hammer. The booklet contains tables giving the dimensions and other characteristics of the five sizes of these hammers and is illustrated with photographs showing the hammers in use on various kinds of construction work. A 12-page pamphlet has also been issued describing steam hammers No. 6 and No. 7, weighing 650 and 150 lb., respectively, which are designed especially for use in driving wood and steel sheet piling.

STEEL POLES.—The Bates Expanded Steel Truss Company, Chicago, has issued a 48-page pamphlet describing the one-piece steel poles formed by shearing and expanding special steel I-sections, which are rolled to five different sizes. The book describes the method of manufacture. It gives complete data on the properties of the poles, on the methods by which they are installed and the various fittings, such as cross-arms, lamp and trolley wire brackets, caps, etc., which are used with these poles. Several pages are devoted to handbook data particularly applicable to this product.

VALUATION STUDIES.—The railways entering Chicago have formed a committee to study the highly specialized problems involved in the valuation of large terminals. The complicated network of tracks in this city makes advisabble their consideration as a whole. In collecting construction costs, much benefit will be secured from the exchange of data between the different carriers. The committee consists of one man from each road.

PERMANENTLY PRESERVES

Reilly Improved Creosote Oil is a permanent preservative for cross-ties and structural timber. It is free from every adulterant and is the cheapest in the long run.

Reilly Improved Creosote Oil is unaffected by climatic changes, dryness or moisture, heat or cold. It is deeply penetrative and permanently preserves the wood until mechanically destroyed.

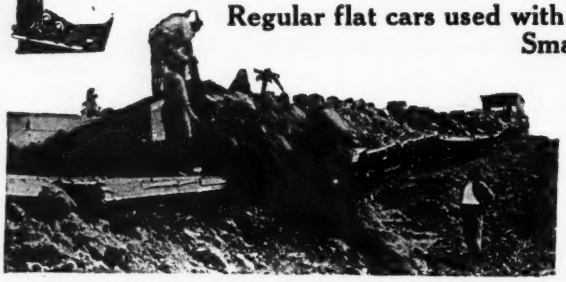
We are prepared to supply Reilly Improved Creosote Oil in any quantity at attractive prices. One gallon will do better work than two gallons of commercial creosote. It stays in the wood. Correspondence cordially invited.

Republic Creosoting Company

Indianapolis, Indiana

LIDGERWOOD RAPID UNLOADER

Regular flat cars used with this method, reducing dead weight haulage. Smaller crews required.



Load can all be dumped in one place.
Load can be spread along any distance.
Cars unloaded at lowest cost.

Send for Bulletin

Hoists for Every Railroad Service

Lidgerwood Mfg. Co. 96 Liberty Street **New York**
PHILADELPHIA PITTSBURGH CHICAGO SEATTLE

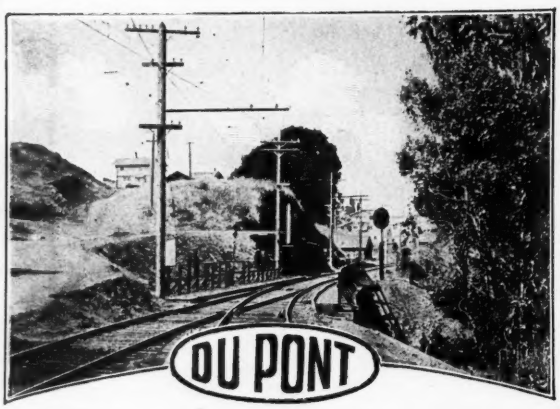
Employment Bureau

POSITION WANTED—The former editor of a well-known engineering periodical is prepared to take charge of the publicity department of a railway supply or manufacturing concern. Possesses long experience and wide personal acquaintance, and is well fitted to write descriptive articles, prepare catalogues, pamphlets, etc., manage and edit a "house organ" and to secure desirable publicity. His extensive knowledge of the technical and daily press makes him of great value both in this respect and also in the judicious placing of advertising. Address Box 2, *Railway Maintenance Engineer*, Woolworth Bldg., New York.

An employment and classified advertising section will be incorporated in this publication whenever there is a demand for such service.

Use this section when seeking a new man, a new position, or when buying or selling second hand equipment.

Rate is 2c a word a month. Minimum charge $1.00. Remittance must accompany each order. Address Railway Maintenance Engineer, Classified Advertising Department, Transportation Bldg., Chicago, Ill.



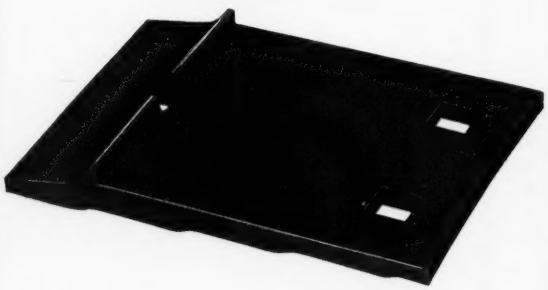
EXPLOSIVES

Reduce Maintenance Costs

FOR building and maintaining your right of way, digging drainage ditches, erecting posts and poles for signal systems and excavations for station foundations, Du Pont Explosives are efficient, economic and practical aids to the construction crews.

Write for free instructive booklet: "Du Pont High Explosives."

E. I. du Pont de Nemours & Co.
Powder Makers Since 1802
Wilmington, Delaware



More than a mere Tie Plate—A safety device—An economic device—A device promoting easy riding Track. The

LUNDIE TIE PLATE

will more than pay for itself in saving of Rail and Wheel wear and in reduction of maintenance expense, as well as performing the usual functions of a Tie Plate.

JOHN LUNDIE, 52 Broadway, NEW YORK

Make This Test On Your Desk

YOU can satisfy yourself that Reeves Wood Preserver does its work quickly and completely by making a simple little test right on your desk. We'll send the testing outfit free upon request.

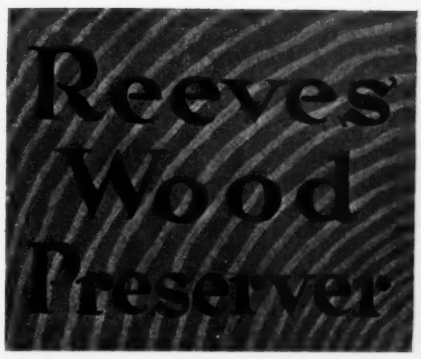
Just remove the cork; place the pine stick in the bottle of Reeves Wood Preserver; leave it there for three minutes (by your watch), then whittle the wood to make sure that the wood preserver actually penetrated to the center of the pine stick. This little practical demonstration shows that it is unnecessary to invest in expensive apparatus in order to protect your cross-ties and other railroad timber from decay.

Reeves Wood Preserver penetrates wood by natural absorption, just as water penetrates a sponge. The treating plant can be located right on the job, as the wood preserver is ready to use without heating, mixing or preparation in any way.

Reeves Wood Preserver does not corrode or destroy metal coming in contact with it and as the preservative is not soluble in water, the protection to the wood is permanent.

MAKE A TEST ON YOUR DESK BEFORE YOU PASS JUDGMENT. WRITE FOR THE FREE TESTING OUTFIT AND LITERATURE.

THE REEVES CO. - - - New Orleans, La.



New York Central

"IMPERIAL" TIE TAMPERS

While attending the Roadmasters' Convention at the Hotel McAlpin, New York City, Sept. 19-23, you will find a visit to our Booth No. 1 of interest.

During the past season "Imperial" Tie Tampers have been adopted extensively by an increasing number of the railroads of the country.

Our representatives at the Booth will be glad to show you the "Imperial" Tie Tamper and supply you with full information about the modern way of track ballasting.

Be sure and get a Copy of Bulletin 9023

INGERSOLL-RAND COMPANY

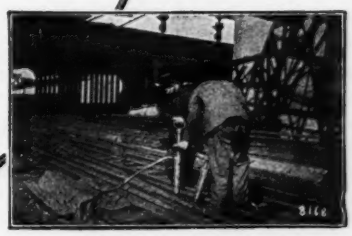
11 Broadway NEW YORK

27-TT

Hudson & Manhattan R. R.

Lackawanna

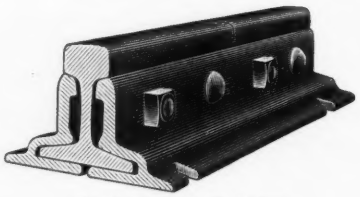
Pennsylvania Terminal



The Rail Joint Co.

GENERAL OFFICES:

61 Broadway New York City



Continuous Rail Joint

Makers of Continuous, Weber, Wolhaupter and 100% rail joints.

Standard—Insulated—Step—Frog and Switch Types.

Grand Prize San Francisco 1915

Protected by Patents

O. G. Fir Gutters (5" x 7") are used on this Atlantic Coast Line Passenger Station at St. Petersburg, Fla.

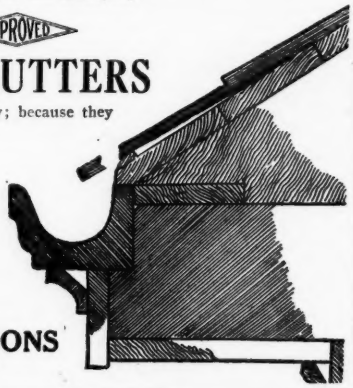
NO METAL GUTTERS HERE

Metal gutters are expensive—not only in first cost—but also in final costs; for there are maintenance and upkeep charges. Metal gutters cannot stand up against corrosion, acid fumes and chemical action of water. That's why railroads are specifying

IMPROVED

O. G. FIR GUTTERS

Because they resist decay; because they last three times as long as metal gutters; because the upkeep charges are nil; because they can be built into the building (see illustration below). There's a double saving in O. G. Fir Gutters. Write and let us explain in detail—our booklet will accompany our letter.



E. M. LONG & SONS
CADIZ, OHIO

Point of Contact

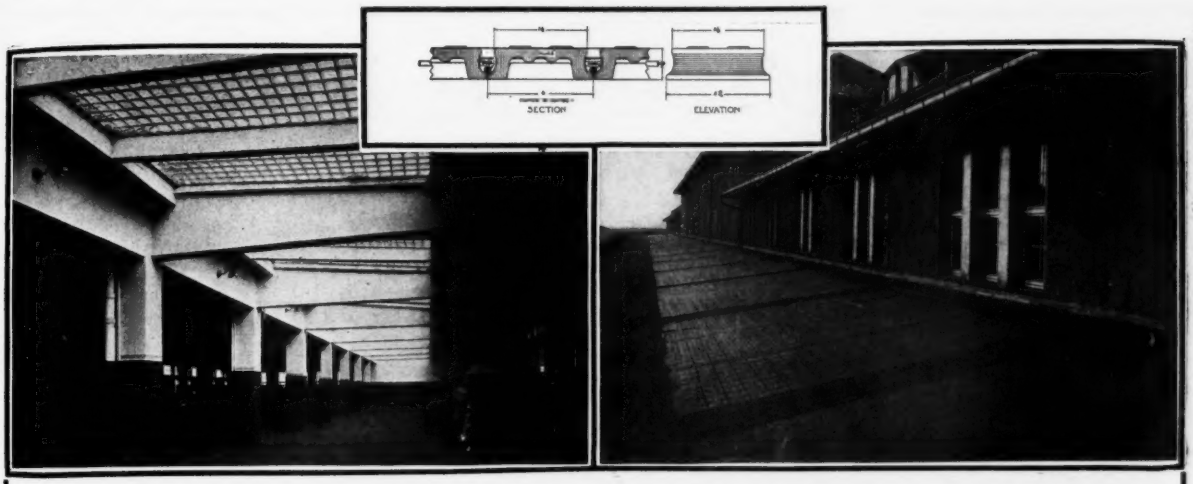
Have you ever tried to analyze your product as to its advertising possibilities? Have you ever gone deep down into its sales possibilities to find the "point of contact" between it and its possible buyers?

Often the "point of contact" is hard to find; for it is always the obvious that escapes us.

If a product or device makes for economy, savings, etc., obviously the point of contact is along these lines—but your message should be so placed before the maintenance of way man that your appeal comes within his experience.

Our copy-service department may be able to assist you in establishing the correct point of contact.

Call upon us to assist you whenever you feel that your copy-plan needs the viewpoint of the man outside



Installation of 3,500 square feet of Keppler Roof Lights in railroad service abroad. In over 5 years not a cent has been spent for repairs and not a single unit has cracked.

The Lehigh Valley Railroad also appreciates low maintenance—they are using 50,000 square feet of Keppler Roof Lights for the Bush Train-shed of their new Buffalo Station.

No Repairs in 5 Years

This installation of Keppler Roof Lights in railroad service has had more than five years' use. Not a single unit has cracked or been replaced. Not a cent has been spent for upkeep.

Keppler Roof Lights

require little or no maintenance—are as fire-resistant as the best wire-glass—will safely support 70 pounds per square foot—have a smooth top surface, making cleaning and removal of snow easy and quick—and have an All-Glass Undersurface, giving the maximum of light.

Keppler Roof Lights are guaranteed against maintenance for one year free and at a nominal sum thereafter for any length of time desired. Lehigh Valley, Delaware, Lackawanna and Western, Pennsylvania, and other great railroads use them.

Bulletin 205 will be mailed upon request.

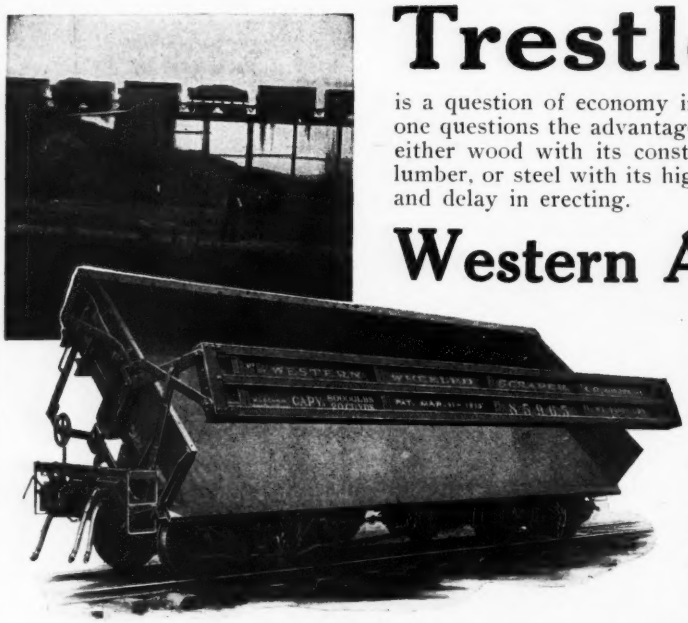
KEPPLER

Glass Constructions N.Y.

TRADE MARK

Architects' Building, 101 Park Avenue, New York

Roof-lights, Vault-lights, Fire-proof Windows, Glass Partitions and Crystal Ceilings for Stations, Train-sheds and other railway buildings



Trestle Filling

is a question of economy in the actual filling operation itself—no one questions the advantages of a solid roadbed over trestle work; either wood with its constant upkeep expense and high price of lumber, or steel with its high initial cost and tremendous difficulty and delay in erecting.

Western Air Dump Cars

can be used where traffic is very heavy, eliminating delays required by some other equipments, such as switching cars out of train, adjusting plows, cables, unloaders, etc. The engineer has full control of the dumping and from his position in the cab can in a few seconds dump the load and return the cars to their upright position.

Hence it is possible for these work trains to operate on short schedule, going in between fast passenger or freight trains and getting out of the way without any delay.

Investigate their records on the Lackawanna cut-off, the Mesabe Iron Range Mines, the Mississippi levees, the Keokuk dam, etc.

Ask for copy of "Railroad Ditching and Trestle Filling."

Western Wheeled Scraper Co., AURORA Illinois

Why Clean Stone Ballast by the Trench-Zepp Method?

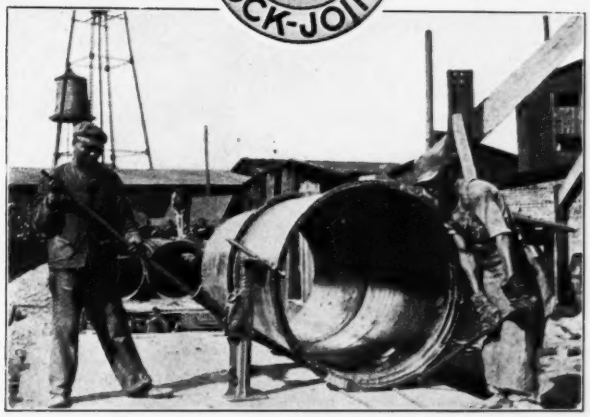
FIVE SECONDS from the time the engineer on an approaching engine toots his whistle at the danger flag the track can be cleared. The two outside screens are designed to clear any car, while in working position. The center screen lays flat between the rails by merely pulling out the two rear legs. When train has passed the screen is raised again to working position without changing location and all is ready for operation.

The **Trench-Zepp Screens** are being operated with a wonderful saving over the old fork method in many places, especially on Eastern Roads. With screens in the position shown in the cut, cleaned ballast can be deposited wherever desired on the track bed. The dirt can be run into bags to be loaded on a flat car at a later time, or can be run into wheelbarrows to be hauled a short distance and dumped, as the occasion demands.

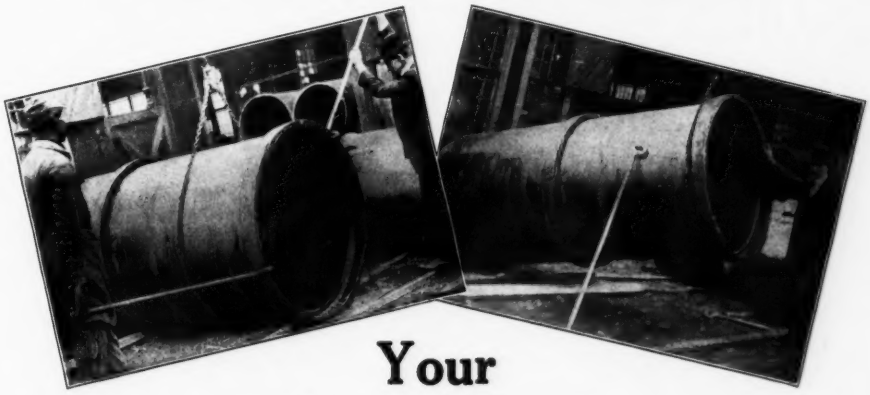
We have undeniable proof that you can save 50 per cent over the old fork method of cleaning ballast by using these screens. **Write to-day for full information.**

Littleford Bros. MANUFACTURERS AND SOLE AGENTS **Cincinnati, Ohio**

Right upper illustration shows method of rotating 48-inch pipe when locking. The only tools required are a monkey-wrench, track jack and bar.



The two lower illustrations show method of locking 48-inch pipe by using chain sling. For complete details, specifications, etc., send for our new booklet.

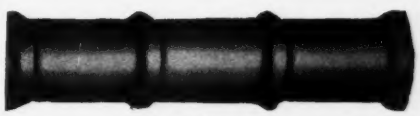


Your Next Culvert

Before you decide on your next culvert, consider the following facts: National Lock Joint Pipe is the solution to the culvert renewal problem and expense; for National Lock Joint Cast Iron Pipe is as permanent as your roadbed. Its short length units (3, 4 and 5 ft.) permit easy handling (see illustration above). Bear in mind that the installation of National Lock Joint Cast Iron Culvert Pipe can be made without interfering with traffic. No piles to drive—no fill to remove—no tunneling required. Rethread the old culvert and back-fill with concrete.

May We Send Our New Booklet

AMERICAN CASTING CO.
Birmingham, Ala.
Chicago Office: - Peoples Gas Building
New England Representative
Fred A. Haudlette & Son - Boston, Mass.
St. Louis Representative
H. P. Webb - - Wainwright Building
St. Paul Office
Contractor's Supply and Equipment Co.

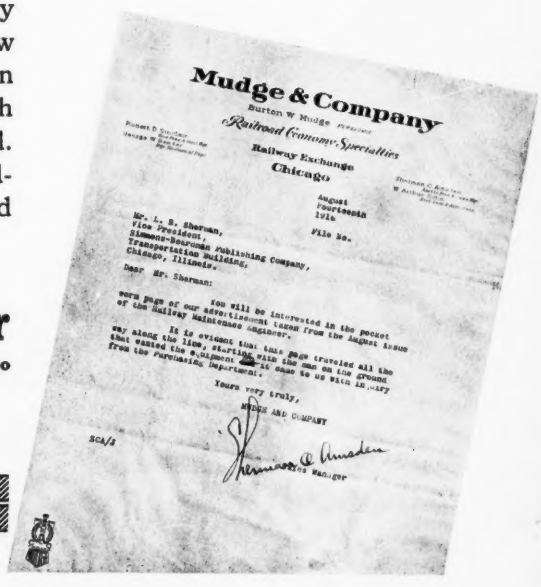


RAILWAY MAINTENANCE ENGINEER
Mr. Roadmaster:
Lengthen my section from 6 to 10 miles --- give me a Mudge "Wonder-Pull" for my old hand car --- I'll then guarantee and prove to you how I can save its total cost --- by time saved --- in less than a year. I can then pay you handsome dividends. Do better work. Keep better men.
Section Foreman
Your Old Pump Cars
PULLS LIKE A BULL
MUDGE "WONDER-PULL"
SECTION MOTOR CAR TOP ASSEMBLED
Mudge & Company
Railway Exchange, Chicago

A Pocket-Worn Page —How It Reached This Stage!

"It is evident that this page traveled all the way along the line, starting with the man on the ground that wanted the equipment as it came to us with inquiry from the Purchasing Department."

The above illustrated page from the August Railway Maintenance Engineer is a graphic illustration of how an order for equipment starts. It often happens in railway routine that a recommendation passes through several hands before the requisition is finally issued. This pocket-worn page and the letter from the advertiser tell the inside story of how the order reached the advertiser.


Mudge & Company
Burton W. Mudge, President
Railroad Economy Specialties
Railway Exchange
Chicago

August Fourteenth 1916

File No.

Mr. L. B. Sherman,
Vice President,
Simmons-Boardman Publishing Company,
Transportation Building,
Chicago, Illinois.

Dear Mr. Sherman:

You will be interested in the pocket ... page of our advertisement taken from the August issue of the Railway Maintenance Engineer.

It is evident that this page traveled all the way along the line, starting with the man on the ground that wanted the equipment. It came to us with inquiry from the Purchasing Department.

Yours very truly,

MUDGE AND COMPANY

SCA/s

Sales Manager

Railway Maintenance Engineer

New York Cleveland Chicago

THE RAILWAY MAINTENANCE ENGINEER HAS APPLIED FOR MEMBERSHIP TO THE AUDIT BUREAU OF CIRCULATIONS